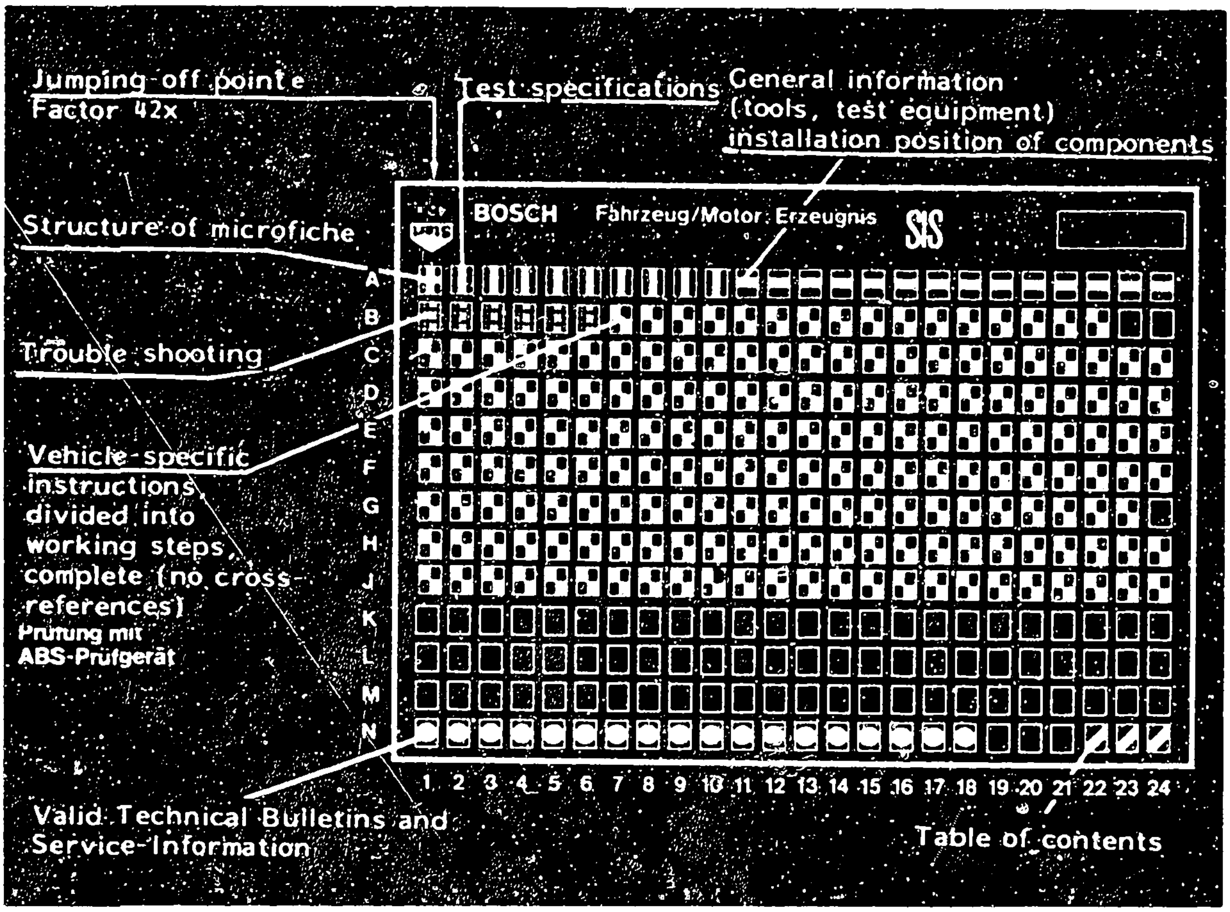
Structure of microfiche



1. Read from left to right
2. Title of microfiche (appears on each coordinate)

E16	Product/component/test step Vehicle/engine

Coordinate

3. Limits of section

Beginning — Mid-section — End — One-page section

4. Purely vehicle-specific passages in the text are marked with a vertical bar.

5. Reference to relevant working steps in the test specifications, e.g. coordinate C6.

C6

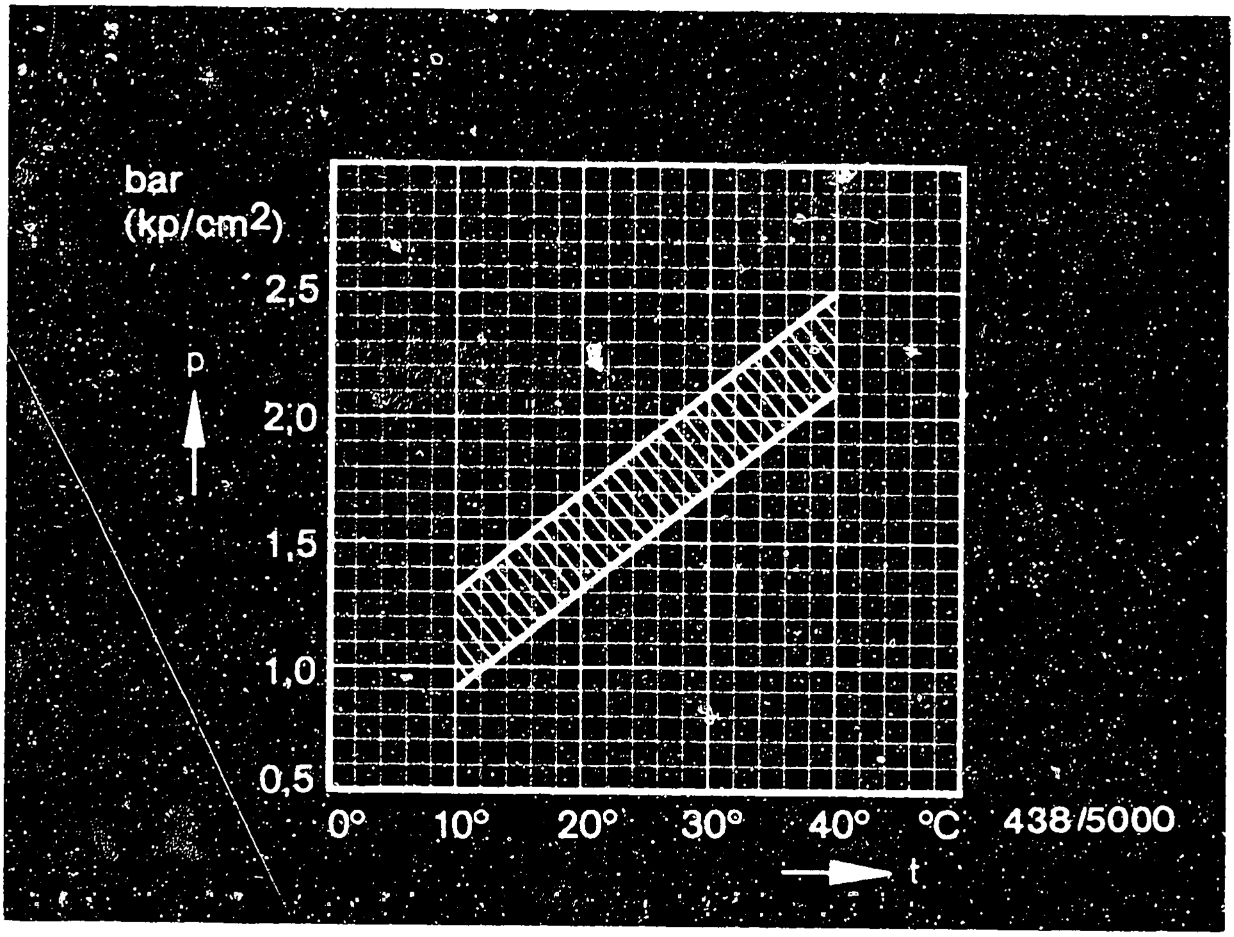
A1	Trouble-shooting program	↓

C2

1. Test values

1.1 Electric fuel pump

Test step	Test values
Delivery rate:	at least 850 cm^3/30 s



p = control pressure (gauge pressure)
t = ambient temperature

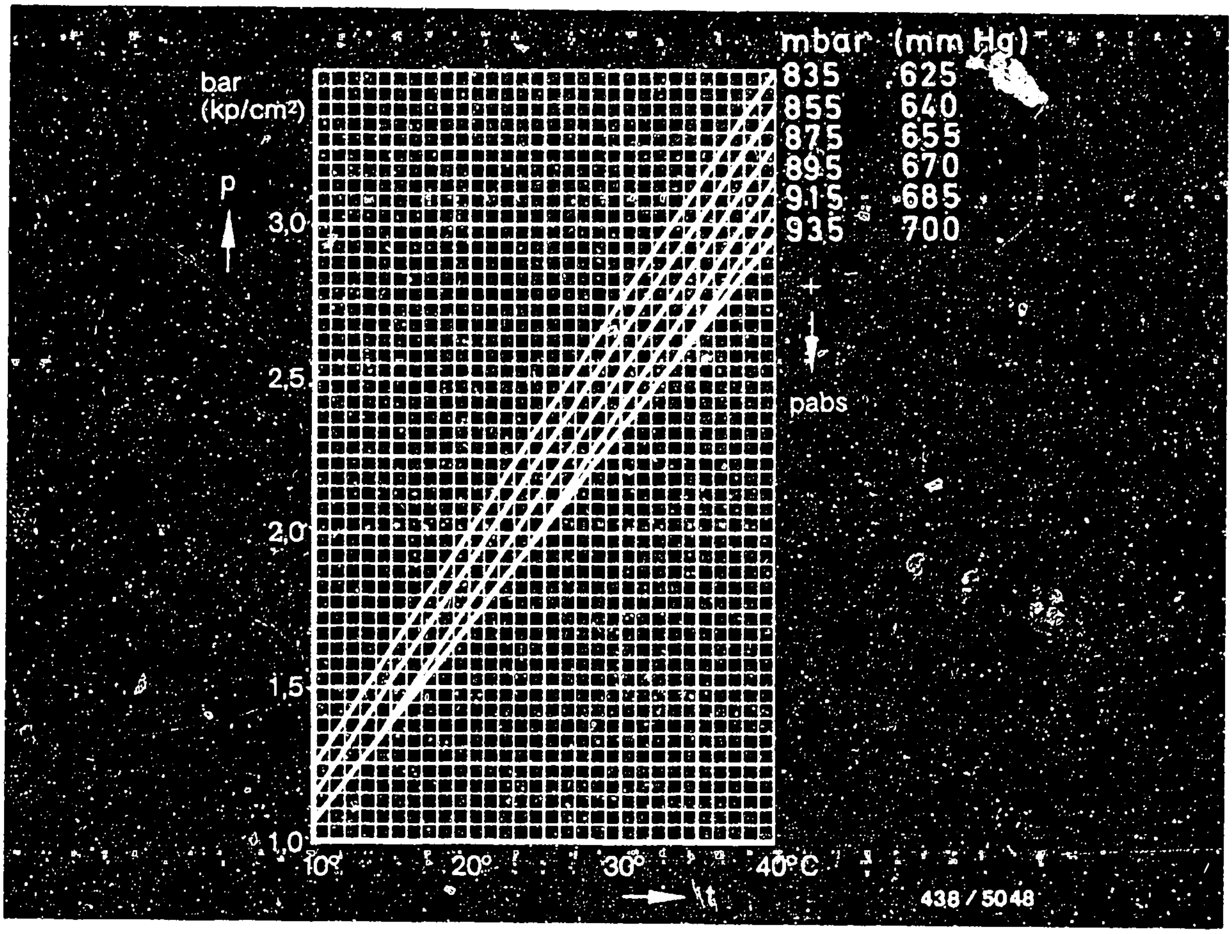
C12

1.2 "Cold" control pressure

Warm-up regulator order number: 0 438 140 094
0 438 140 095

(Model for acceleration enrichment)

Check with engine off, i.e. without manifold pressure.



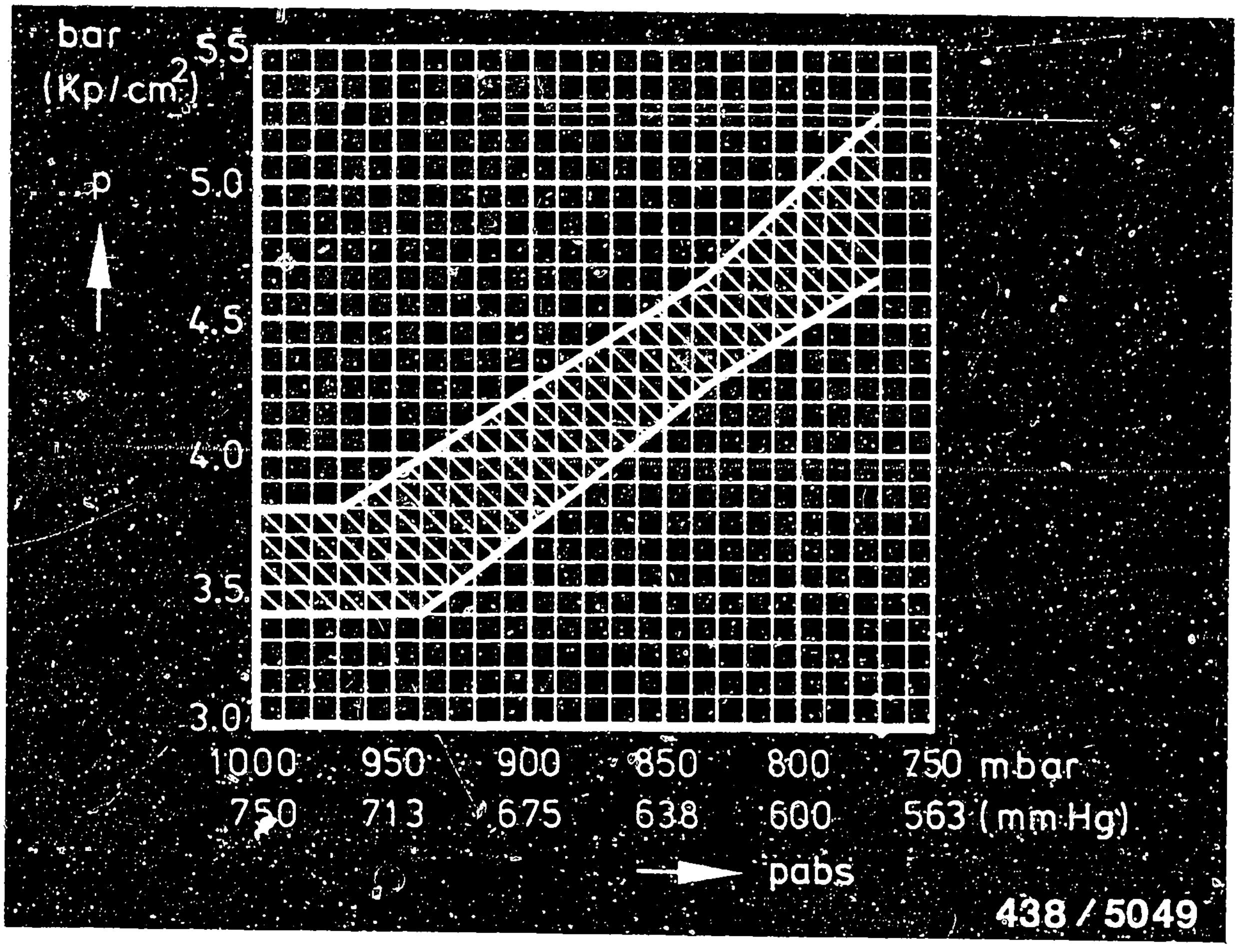
p = control pressure (gauge pressure)
t = ambient temperature
pabs = air pressure

C 12

"Cold" control pressure

Warm-up regulator order number: 0 438 140 130/... 131 (model with altitude compensation)

Read control pressure set point on graph opposite corresponding ambient temperature and atmospheric pressure.
A tolerance of ±0.2 bar applies to the basic control pressure curve.
A tolerance of ±0.25 bar applies to the control pressure altitude curves.
The basic curve applies to atmospheric pressure greater than 935 mbar (700 mm Hg).



p = control pressure (gauge pressure)
pabs = air pressure

1.3 "Warm" control pressure

Warm-up regulator order number: 0 438 140 130/... 131
(model with altitude compensation)

Measure the control pressure immediately after the warm-up regulator has settled.

"Warm" control pressure

- Measure at atmospheric pressure (without vacuum)

  Warm-up regulator order number:
  0 438 140 094
  0 438 140 095 — 3.4 ... 3.8 bar (3.5 ... 3.9 kp/cm²)

- Connect vacuum pump to measure pressure at the intake manifold pressure connection of the warm-up regulator.
  Setting value:
  400 ... 600 mbar
  (300 ... 450 mm Hg)

  Warm-up regulator order number:
  0 438 140 094
  0 438 140 095 — 1.4 ... 1.8 bar (1.5 ... 1.9 kp/cm²)

* Pressures are indicated in bar (gauge pressure) and kp/cm² (gauge pressure)

Test step	Test values*

C 12

1.4 Leak test of both chambers

Setting value:
400 ... 600 mbar
(300 ... 450 mm Hg)

Warm-up regulator order No.	maximum permissible pressure drop:
0 438 140 094 0 438 140 095	100 mbar (75 mm Hg)/15 s

D 14

1.5 Primary pressure

Fuel distributor order No.	Test value:	Setting value:
0 438 100 127	4.7...5.4 bar (4.8...5.5 kp/cm^2)	4.9...5.1 bar (5.0...5.2 kp/cm^2)

D 22

1.6 Leak test

Fuel accumulator No.	minimum pressure after 10 min	minimum pressure after 20 min
0 438 170 040 0 438 170 041	2.5 bar (2.6 kp/cm^2)	2.4 bar (2.5 kp/cm^2)

E 21

1.7 Injection valve

Injection valve No.	
0 437 502 023 0 437 502 024	opening pressure: 3.0...4.1 bar (3.1...4.2 kp/cm^2)

* Pressures are indicated in bar (gauge pressure) and kp/cm^2 (gauge pressure)

F7

1.8 Fuel distributor

Delivered quantity comparison.
Fuel distributor order number: 0 438 100 127

	Set point	Max. permissible delivery rate
Idle	6.0 cm³/min	6.6 cm³/min
Part load	40.0 cm³/min	43.0 cm³/min
Full load	140.0 cm³/min	155.0 cm³/min

The full-load delivery rate must be achieved or exceeded at maximum air sensor plate deflection.

F18

1.9 Idle adjustment*

- Idle speed

Air conditioner off	730...870 min^{-1}
Air conditioner on	830...970 min^{-1}

With idle speed setting device current

Air conditioner off	410...450 mA
Air conditioner on:	
Manual transmission	470...510 mA
Automatic transmission	480...520 mA

- CO constituent 0.3...1.2 % by volume

With repetition rate oscillating

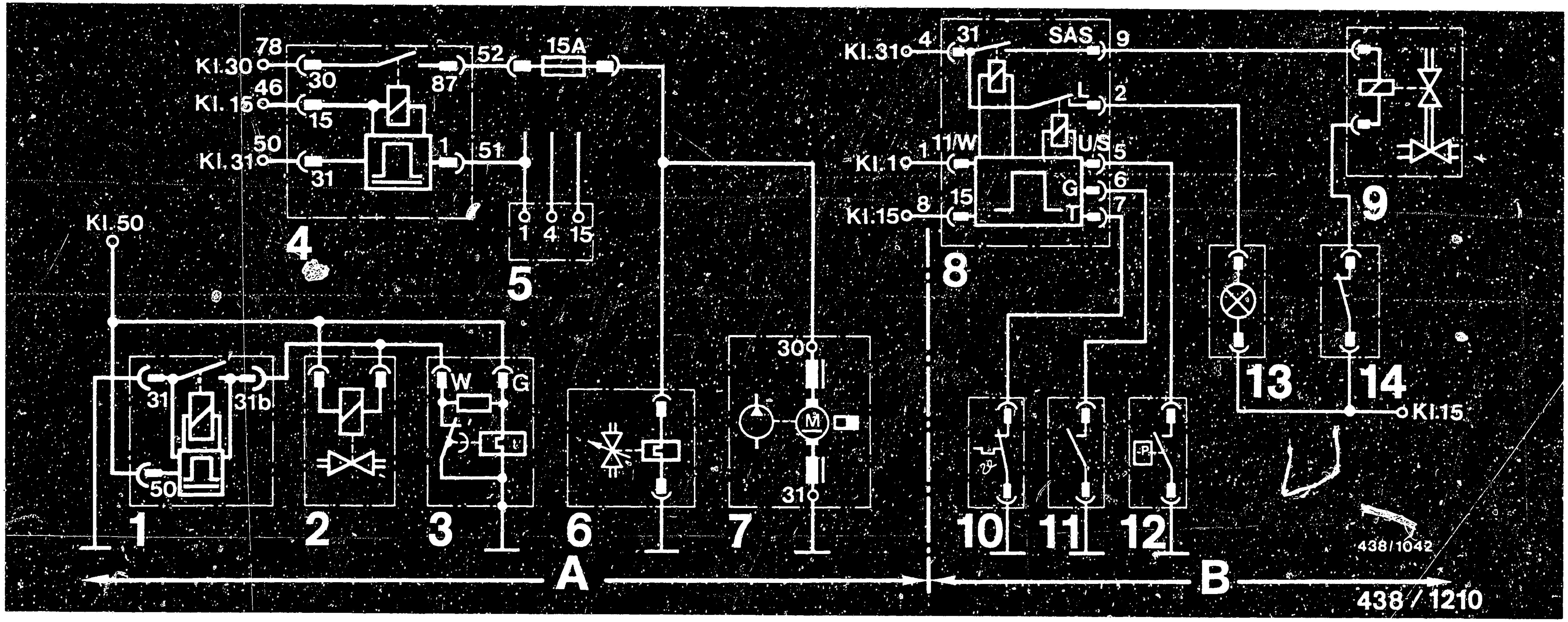
Test value	25...65%
Setting value	50%

* To set or check idle speed, turn on high-beam lights and turn off air conditioner. The engine should be at operating temperature, with an oil temperature of approx. +80°C. The radiator fan must not run. Switch off overrun fuel cutoff and exhaust gas recirculation systems (if equipped). Remove crankcase breather hose from cylinder head and close off hose end.

Test step	Test values
1.10 Lambda closed-loop control*	
Repetition rates:	
t_0 (lean mixture stop)	max. 20%
t_1 (open-loop control)	45...55%
t_2 (rich mixture stop)	at least 87%
t_3 warm-up or	75...85%
t_4 full load enrichment	60...70%
Oscillating closed-loop control between	25...65%
• Thermostatic switch	
closed	below +20°C
open	above +30°C
• Thermo-valve	
opening temperature	52...58°C, cold = open
closing temperature	62...68°C, warm = closed
1.11 Overrun fuel cutoff system	
• Shut-off speed	> 1200 min^{-1}
• Throttle valve micro-switch switching point	1...2.5° throttle valve position
• Fuel cutoff valve	approx. 40...90Ω
• Thermostatic switch	
closed	below +30°C
open	above +40°C
1.12 Potentiometer on air flow sensor	
Total resistance	3000...5000Ω
Idle resistance	500... 900Ω
Full-load resistance	3500...6000Ω

* Functional check and setting of the lambda closed-loop control system:

Run the engine up to operating temperature with the lambda probe connected.
Then disconnect the probe lead; set the CO value.
Reconnect the probe lead. The CO value must now drop to a maximum of 1.0%. Checking the repetition rates: The difference between t_2 and t_3 must be noticeable.



A = Fuel injection system and ignition system components

1 = Impulse relay
2 = Cold-start valve
3 = Thermo-time switch
4 = Electronic relay
5 = Ignition coil
6 = Warm-up regulator
7 = In-tank electric fuel pump

B = Overrun fuel cutoff system and shift indicator

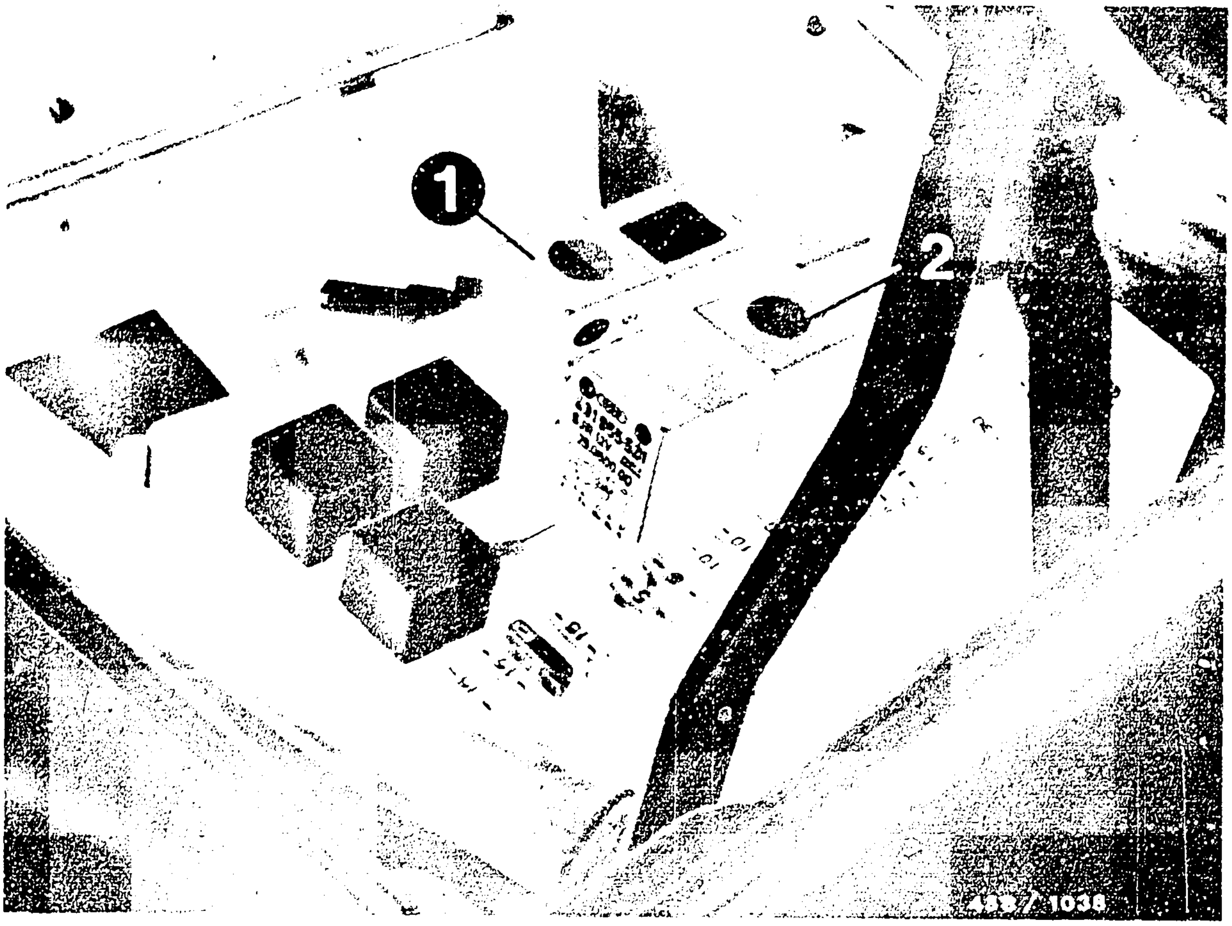
8 = Control unit for shift indicator (only for vehicles with manual transmissions)
9 = Fuel cutoff valve
10 = Thermo-time switch
11 = Gear shift
12 = Vacuum-operated switch
13 = Lamp for shift indicator
14 = Throttle valve switch

2. Electrical safety circuit with overrun fuel cutoff system and shift indicator

2.1 Circuit diagram

The safety circuit with electronic relay is driven by terminal 1 of the ignition coil.

The fuel cutoff valve and the lamp for the shift indicator are supplied with power by the control unit for the shift indicator.



1 = Control unit for shift indicator and overrun fuel cutoff system
2 = Electronic relay

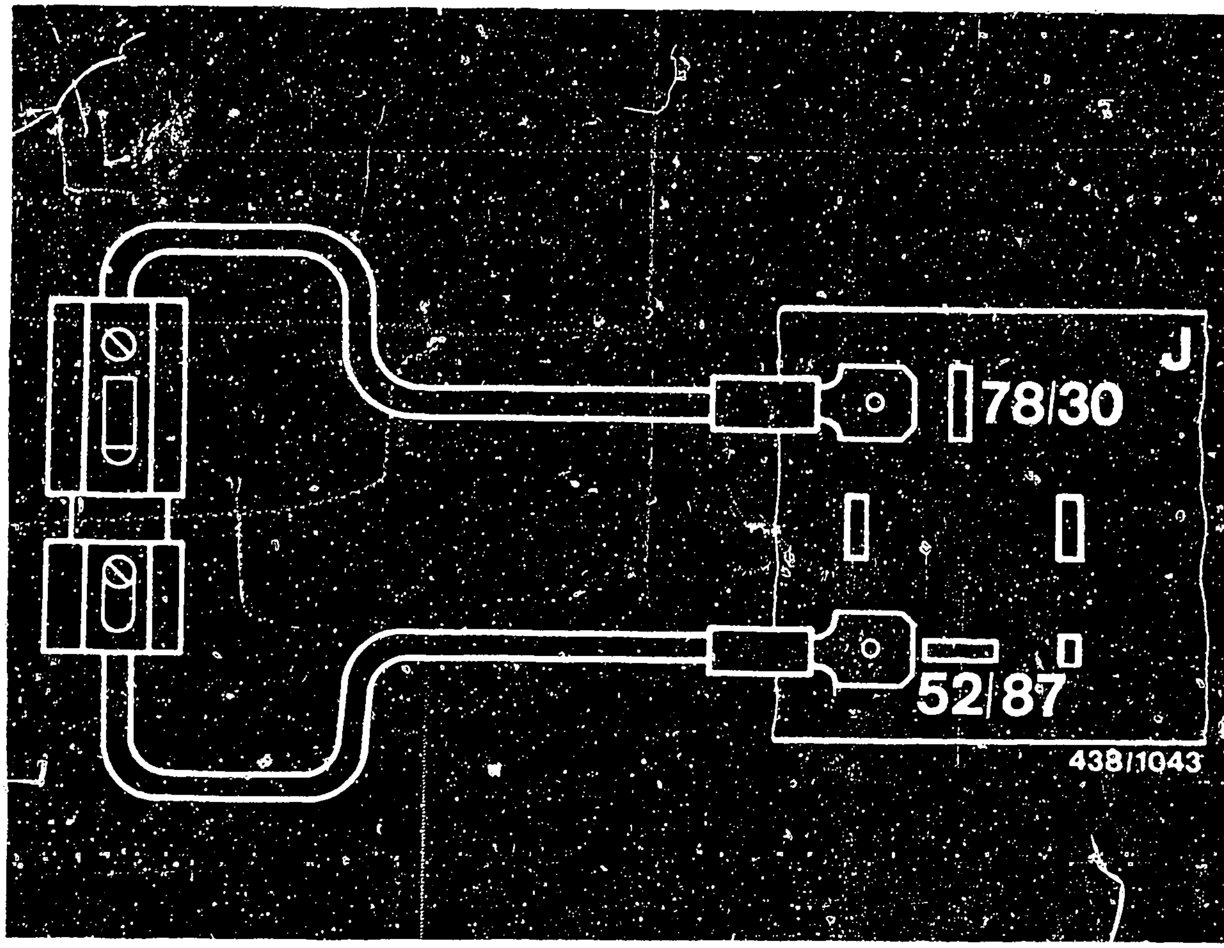
2.2 Warm start feature

During every warm start the start valve is actuated by an impulse relay and sprays additional fuel intermittently into the intake manifold.
During cold starting this function is overridden by the thermo-time switch.

2.3 Bridging the safety circuit

Bridge the safety circuit to carry out these tests with the engine off.

The circuit is bridged by removing the electronic relay from the relay baseplate in the central electronics unit at the left ahead of the windshield in the engine compartment.



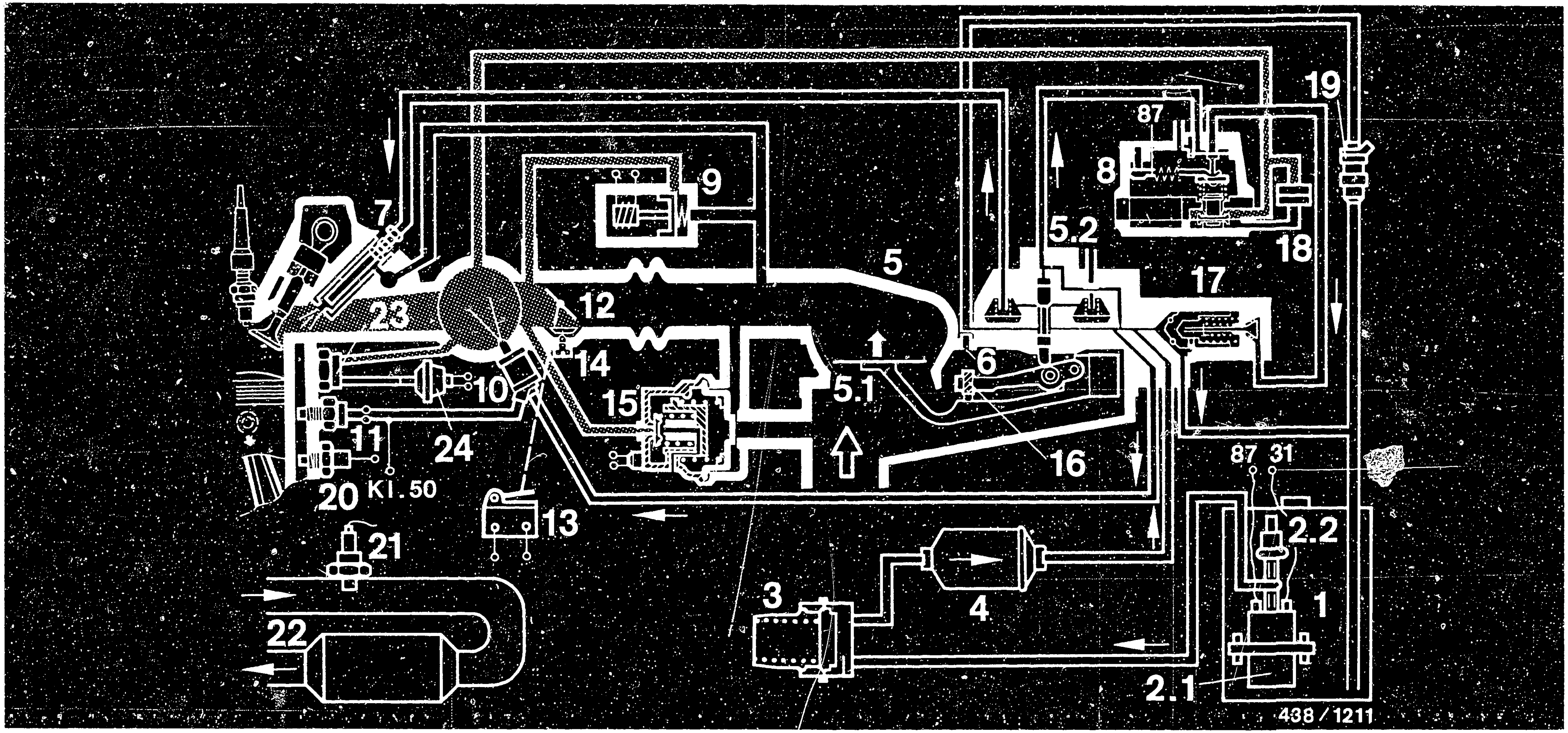
Use a jumper to connect contacts J 78/30 and J 52/87 in the relay baseplate.

Use a 1.5 mm² lead with fuse holder and 16 ampere fuse.
Width of flat contact: 9.5 mm
(User fabricated as per drawing)

Battery voltage is applied via this jumper to the electric fuel pump and the warm-up regulator.

C A U T I O N !

Never lift the sensor flap with the engine running because fuel will be injected. Subsequent starting can lead to severe engine damage!



1 = Fuel tank
2.1 = In-tank electric fuel pump
2.2 = Pressure damper
3 = Fuel accumulator
4 = Fuel filter
5 = Mixture control unit
5.1 = Air flow sensor
5.2 = Fuel distributor
6 = Safety cap
7 = Injection valve
8 = Warm-up regulator
9 = Idle speed setting device
10 = Cold-start valve
11 = Thermo-time switch
12 = Throttle valve
13 = Microswitch
14 = Bypass screw
15 = Fuel cutoff valve
16 = Idle mixture screw
17 = Primary pressure regulator with push valve
18 = Restrictor
19 = Stepping valve
20 = Thermostatic switch
21 = Lambda probe
22 = Catalytic converter
23 = Thermo-valve
24 = Pressure jump switch

3. Fuel line diagram

4. General information

4.1 Introduction

The following VW-Audi models are equipped with 2.0 l - 2.2 l 5-cylinder engines with K-Jetronic and lambda closed-loop control systems:

Audi 5000, 4000/5, Coupe VW Quantum	(from July 1982)	USA model
Audi 100 VW-Nissan, Santana	(from July 1982) (from Sept. 1983)	Japanese model

The following repair instructions apply only to these vehicles and explain in succinct form how to check and set the various components of the K-Jetronic system.

All system components are covered in individual sections with their corresponding test values.
In addition to these repair instructions, each subsequent vehicle model equipped with the K-Jetronic system will have its own set of test and repair instructions.

The design and operation of the K-Jetronic system differs from other fuel injection systems. The K-Jetronic system and its operation should be understood before attempting the tests and component evaluations contained in these instructions. The essential points of K-Jetronic system design and operation are contained in Technical Instruction VDT U 3/1 De.

4.2 System design

The K-Jetronic system as used in these vehicles is the basic system as described in Techncial Instruction VDT-U 3/1 De, with the following exceptions:

4.3 The following components are either new or of a different design:

- In-tank electric fuel pump with removable check valve and integral screw-mounted pressure damper for noise reduction.
  The complete unit snaps in place on the inside bottom of the fuel tank.
  A closure ring on the top of the fuel tank provides access to the electric fuel pump.

- 5-cylinder mixture control unit with updraft air flow sensor.
  Some units have angle pickups (potentiometers) for indication of fuel consumption.

- Warm-up regulator:
  up to May 1983 for acceleration enrichment
  from June 1983 for altitude compensation

- Injection valve with air collector for improved mixture formation, particularly at idle.
  Air distribution occurs in the cylinder head.

- No auxiliary air device; replaced by idle speed setting device with control unit (relay) for idle speed stabilization (not a Bosch product). Operation is similar to the Bosch closed-loop idle speed filing control.

- Temperature- and speed-dependent overrun fuel cutoff system supplied as standard in vehicles with manual transmissions.
  Electrically actuated by throttle valve microswitch and control unit (relay) for shift indicator.

- Electrical safety circuit for electric fuel pump and warm-up regulator via electronic relay.
  This prohibits the electrical fuel pump from starting and the warm-up regulator from prematurely settling with the engine off and the ignition switch on.

- During every warm start the start valve is actuated by an impulse relay and sprays additional fuel intermittently to the intake manifold.
  During cold starting this function is overridden by the thermo-time switch.

- For cleaner exhaust gas, these vehicles are equipped with lambda closed-loop control systems and catalytic converters.

  Important: These vehicles require unleaded gasoline!

  If leaded gasoline is used, it will clog the lambda probe and the catalytic converter, and engine performance will drop.

  Lambda closed-loop control components:

- Lambda probe
- Control unit
- Thermostatic switch
- Stepping valve
- Odometer (in miles)
- Pilot light

- Vehicles built as of June 1983 are additionally equipped with a thermo-valve and pressure jump switch for acceleration enrichment during the warm-up phase via the control unit.

5. Test equipment and tools

- Pressure tester KDJE-P 100 (formerly KDEP 1034).
  Used for leak tests and for checking all fuel pressures.

- Connecting parts set KDJE-P 100/12 (formerly KDEP 1034/12).
  Used for connecting the pressure tester to the warm-up regulator inlet.

- Adjustment wrench KDEP 1035
  Used for setting the idle mixture screw in the mixture control unit (setting the CO value).

- Guide ring KDEP 1040/10 (dia. 80 mm)
  Used for centering the sensor plate in the air flow sensor.

- Tester for delivered quantity comparison KDJE-P 200 (formerly KDJE 7451).
  Used for making a delivered quantity comparison of the individual outlets of the fuel distributor.
- Graduate (commercially available, vol.: about 1.5 l)
  Used for measuring the quantity of fuel delivered by the electric fuel pump.
- Test lead KDJE 7450/70
  Used for direct connection to the component under test, e.g. the cold-start valve.

- Tool set for removing and replacing the idle speed CO safety device of the air flow sensor.
  (e.g. No. 452177 made by Hazet, 5630 Remscheid, West Germany).

- Multimeter, Ri $\geq$ 20 kΩ/V, commercially available.

- Protractor KDJE-7462
  Used for setting the throttle valve microswitch.

- Valve tester KDJE-P 400 (formerly KDJE 7452).
  Used for checking the injection valves.

Test fluids: White spirit (Shell K 30, Esso-Varsol, Shell Mineral Spirits 135) or Bosch, order designation VS 14942 - CH formerly order number 5 973 340 650
Bosch white spirit is available in 5-liter containers from the following company:
Oskar Gnamm GmbH & Co
D-7531 Kaempfelbach-Bilfingen, W. Germany

Caution!

For reasons of safety, gasoline or similar highly-flammable or combustible liquids must never be used.

Follow local official regulations even when using white spirit.

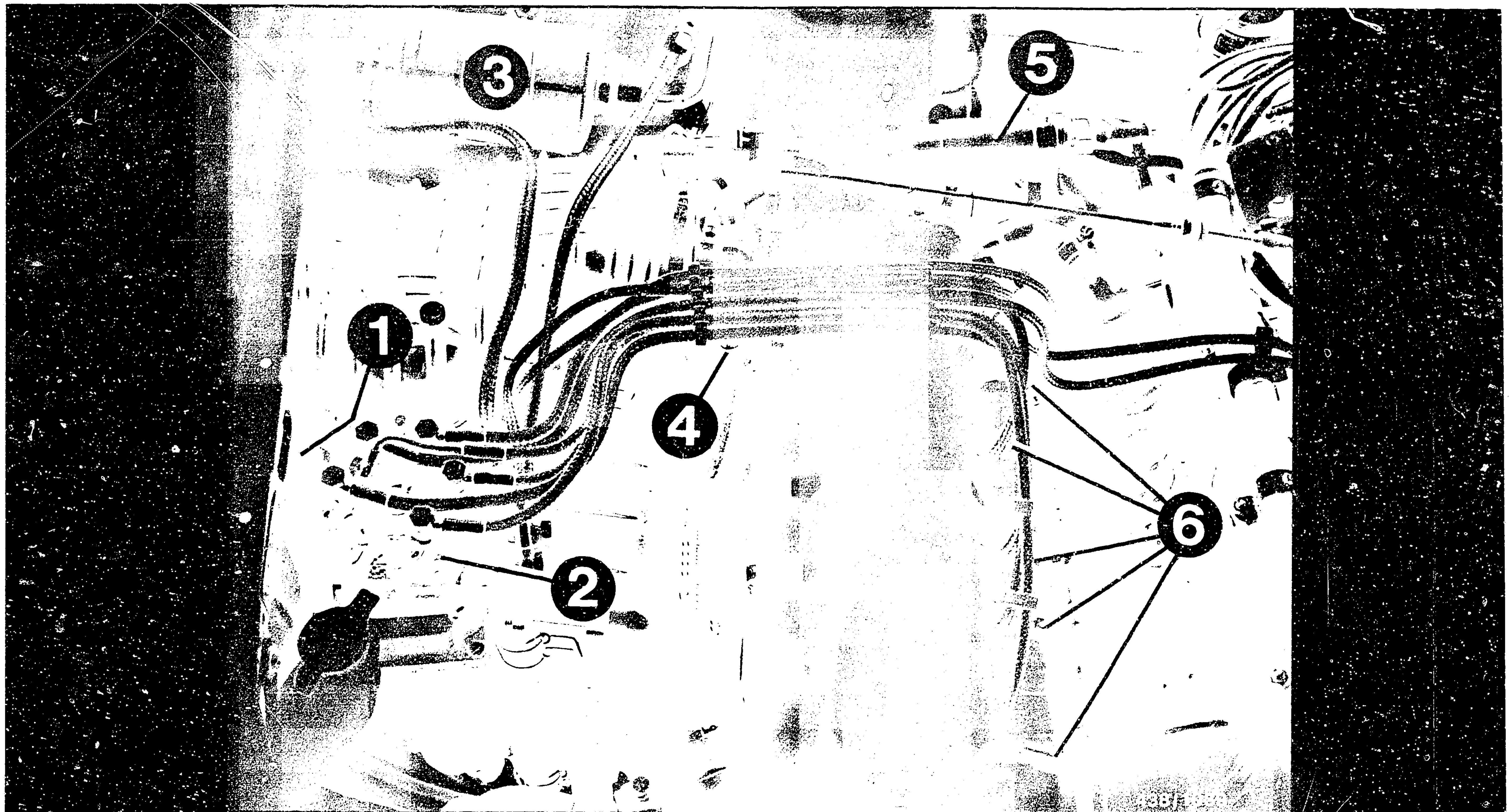
- Tachometer (commercially available)
  For setting idle speed

- CO tester (commercially available)
  For measuring idle speed CO setting

- Vacuum pump (commercially available)
  For testing warm-up regulators with manifold pressure dependent full-load or acceleration enrichment, as well as for checking the pressure jump switch.
  The "Mityvac" hand vacuum pump is available from the following company:

  K o r i n t h
  Ludwig-Kloos-Strasse 21
  6450 Hanau 7 (Steinheim)

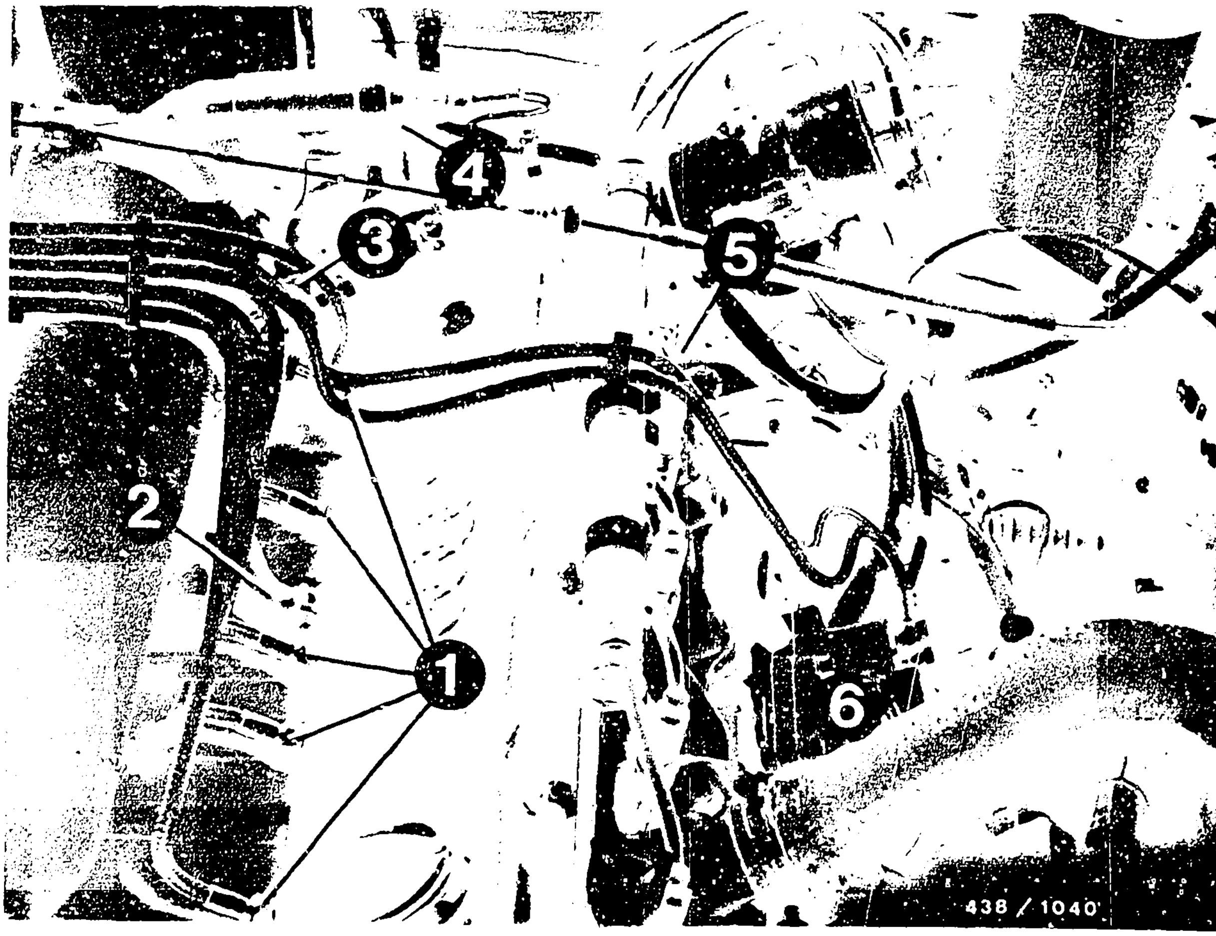
- Lambda closed-loop control tester KDJE-P 600
  For measuring the repetition rates of the lambda closed-loop control.



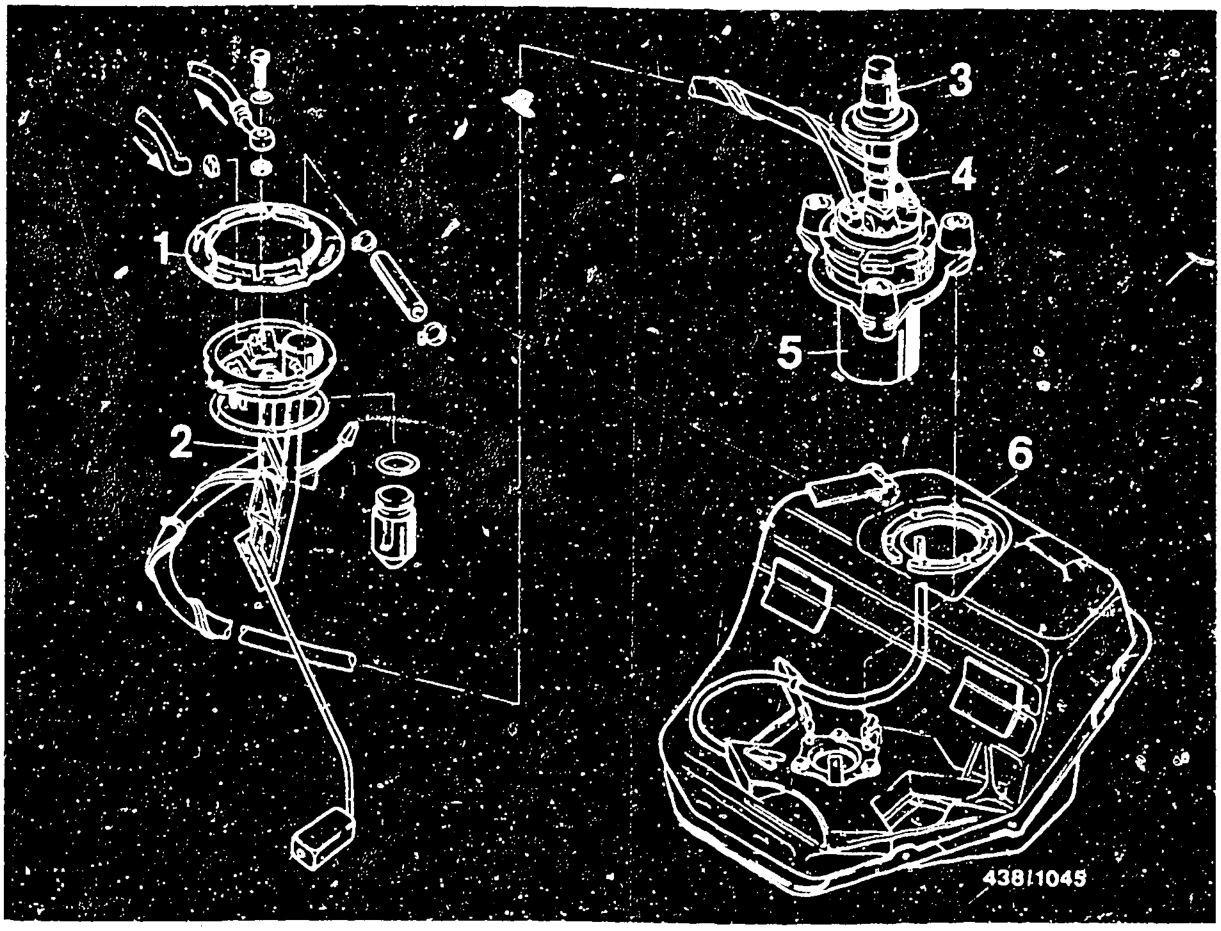
1 = Fuel cutoff valve (hidden behind the right-hand side wall)
2 = Mixture control unit
3 = Fuel filter
4 = Microswitch (hidden beneath the throttle valve assembly)
5 = Idle speed setting device
6 = Injection valves

6. Component locations

6.1 Location of engine components



1 = Injection valve
2 = Air supply for air collector of the injection valves
3 = Start valve
4 = Idle speed setting device
5 = Thermo-time switch
(on front of cylinder block - not visible)
6 = Warm-up regulator



1 = Closure ring
2 = Pickup for fuel indicator
3 = Pressure damper
4 = Check valve
5 = Electric fuel pump
6 = Fuel tank

6.2 Fuel supply components

The in-tank electric fuel pump with removable check valve and screw-mounted pressure damper is accessible via the closure ring on the top of the fuel tank.

The fuel accumulator (arrow) is mounted in a retainer beneath the vehicle at the right in front of the fuel tank.

7. Troubleshooting chart

Troubleshooting the K-Jetronic system assumes that the ignition system is functioning properly and that the engine is in good mechanical condition.

The individual test sections of these repair instructions are comprehensive and can be performed individually. This makes selective troubleshooting possible without having to run through the entire test program for each problem.

The troubleshooting chart at coordinates B 2 - B 5 should make it easier to determine which test sections are required for the faults in question.

Determine the possible cause in the troubleshooting chart on the basis of the complaint registered by the customer or the fault you yourself have found. The coordinates given at the end of the column of causes refer to the corresponding test sections with the appropriate test values.

Important note:

Always use new seals and gaskets when restoring any fuel connections or reinstalling components, including those of the vacuum system.

When working on the K-Jetronic system observe absolute cleanliness at all times.

Clean the outsides of all fuel system components before disconnection.

Troubleshooting chart (also see coordinates B4/B5)

Customer complaint (symptom)

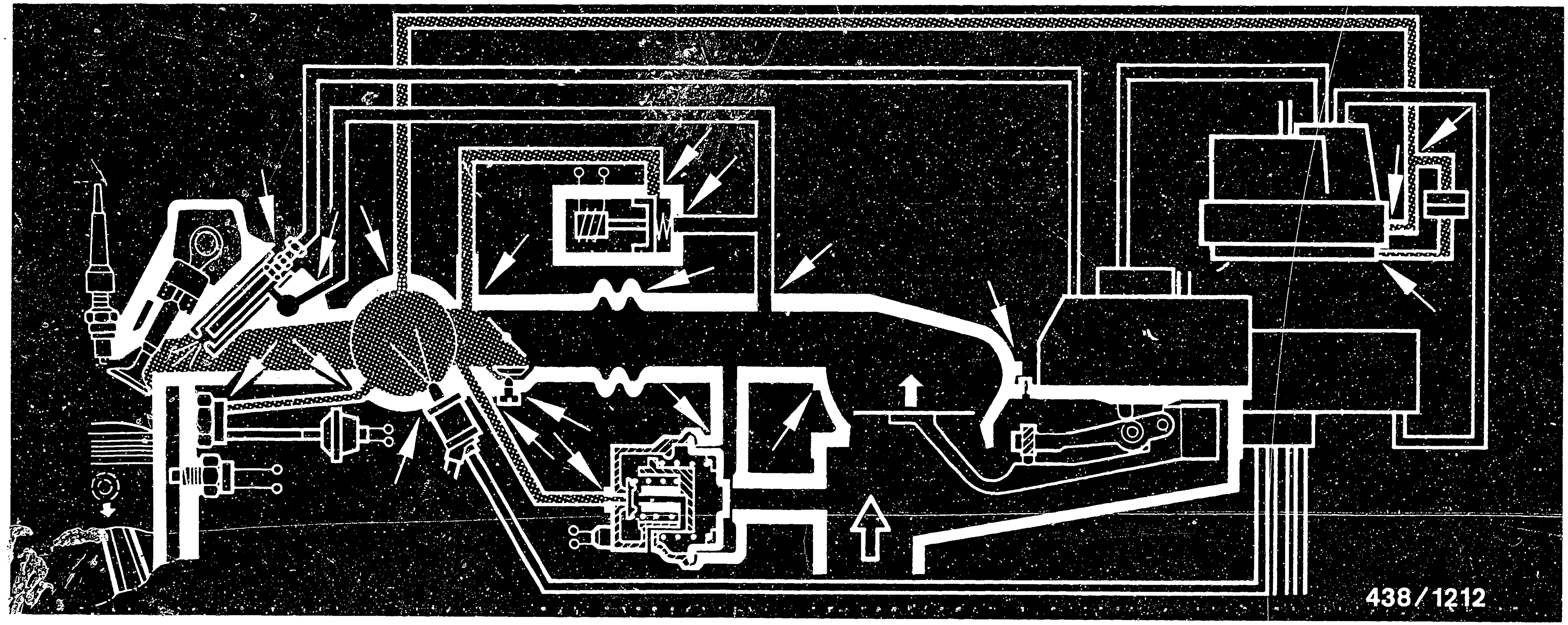
1. Engine does not start or is difficult to start when cold
2. Engine does not start or is difficult to start when warm; difficult to start when hot
3. Uneven idling during warm-up phase (engine shakes)
4. Uneven idling of warm engine (engine shakes)
5. Engine will not accept fuel; engine coughs
6. Engine misfires at driving speed, high load
7. Driving performance unsatisfactory

1.	2.	3.	4.	5.	6.	7.	Causes	Coordinates
	●	●	●	●		●	Vacuum system not leak-tight	B 6
●	●		●	●	●	●	Air flow lever or control plunger does not move freely	B 8
	●						Incorrect sensor plate position	B 18
●		●					Faulty idle speed stabilization	J 8
	●	●	●	●		●	Faulty overrun fuel cutoff system	H 13
●	●				●		Electric fuel pump does not operate	C 2
●	●						Cold-start system defective, impulse relay defective	C 7
		●	●				Cold-start valve not leak-tight	C 7
				●			Fuel quantity too large for control pressure circuit	C 15
●		●					"Cold" control pressure out of tolerance	C 12
	●		●	●	●	●	"Warm" control pressure (settled) too high	C 12
			●	●		●	"Warm" control pressure (settled) too low	C 12
					●	●	Primary pressure out of tolerance	D 14
	●						Overall fuel system not leak-tight	D 22
●	●	●	●		●		Injection valves not leak-tight, opening pressure too low	E 21
●	●	●	●			●	Unequal delivery of fuel	F 6
●	●	●	●	●			Basic CO setting incorrect	F 18
						●	Throttle valve does not fully open	---
		●	●	●		●	Faulty lambda closed-loop control, thermo-valve and pressure jump switch	G 4

Troubleshooting chart (see also coordinates B2/B3)
Customer complaint (symptom) (cont.)

8. Engine runs on
9. Fuel consumption too high
10. Malfunctions between speed ranges
11. Idle CO value too high
12. Idle CO value too low
13. Idle speed cannot be adjusted (too high)
14. Engine starts, then stops immediately
15. Fuel indicator incorrect

8	9	10	11	12	13	14	15	Cause	Coordinates
		●		●				Vacuum system not leak-tight	B 6
●		●	●	●				Air flow lever or control plunger does not move freely	B 8
●								Incorrect sensor plate position	B 18
					●			Faulty idle speed stabilization	J 8
	●	●		●		●		Faulty overrun fuel cutoff system	H 13
						●		Electric fuel pump does not operate	C 2
●	●		●					Cold-start valve not leak-tight	C 7
		●				●		Fuel quantity too large for control pressure circuit	C 15
		●				●		"Warm" control pressure (settled) too high	C 12
	●	●	●			●		"Warm" control pressure (settled) too low	C 12
		●				●		Primary pressure out of tolerance	D 14
●								Injection valves not leak-tight, opening pressure too low	E 21
		●						Unequal delivery of fuel	F 6
●	●	●	●	●				Basic CO setting incorrect	F 18
	●	●	●	●				Faulty lambda closed-loop control, thermo-valve and pressure jump switch	G 4
							●	Faulty angle pickup (potentiometer) on air flow sensor	J 17
							●	Faulty on-board computer or display	---



Test sections

8. Checking air intake system for leaks

The arrows in the illustration above indicate typical points where leaks may occur. Check these points visually, and proceed as follows if in doubt: Remove hose at outlet of idle speed setting device and blow air through hose into intake system using compressed air gun; open throttle valve all the way. Brush sealing points with soapy water or spray with leak detector (e.g. Guepoflex).
Never use combustible fluids to perform leak tests.
Leaks are indicated by the formation of bubbles or foam.
When performing leak tests, pay particular attention to injection valve O-rings and insulating sleeves. If necessary, tighten using a hexagonal offset wrench (11 mm). After repairing any leaks, reset the idle speed with the engine at operating temperature.
The idle adjustment procedure is explained at coordinates F 18.

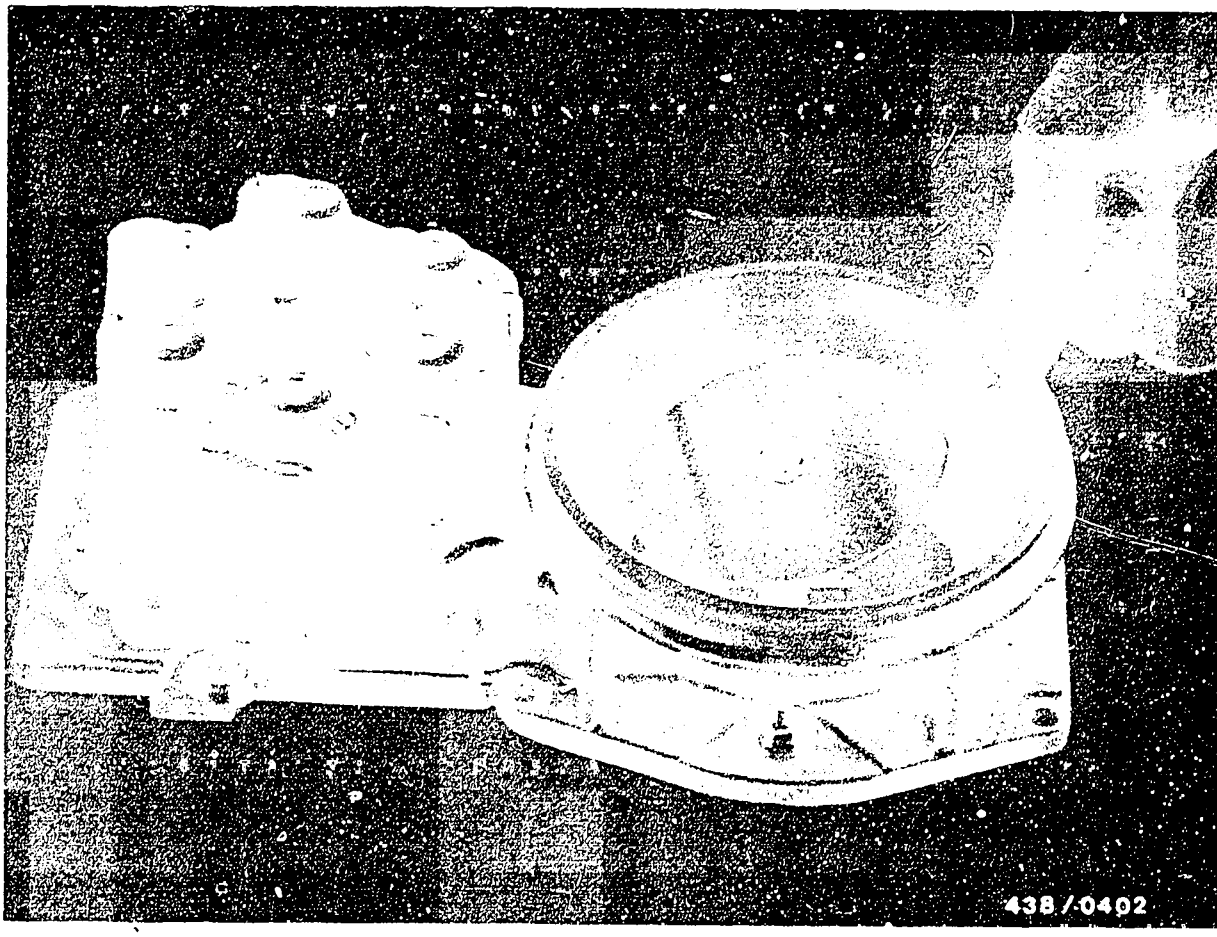
9. Checking the main lever in the air flow sensor and the control plunger in the fuel distributor for freedom of movement

9.1 Preparations

- Engine temperature must be at least +20°C.
- Remove rubber cover (loosen 2 clamping bands) to provide access to the sensor plate of the air flow sensor.
- Run the electric fuel pump for a period of approx. 10 seconds by bridging the safety circuit.
  This applies control pressure to the control plunger in the fuel distributor.

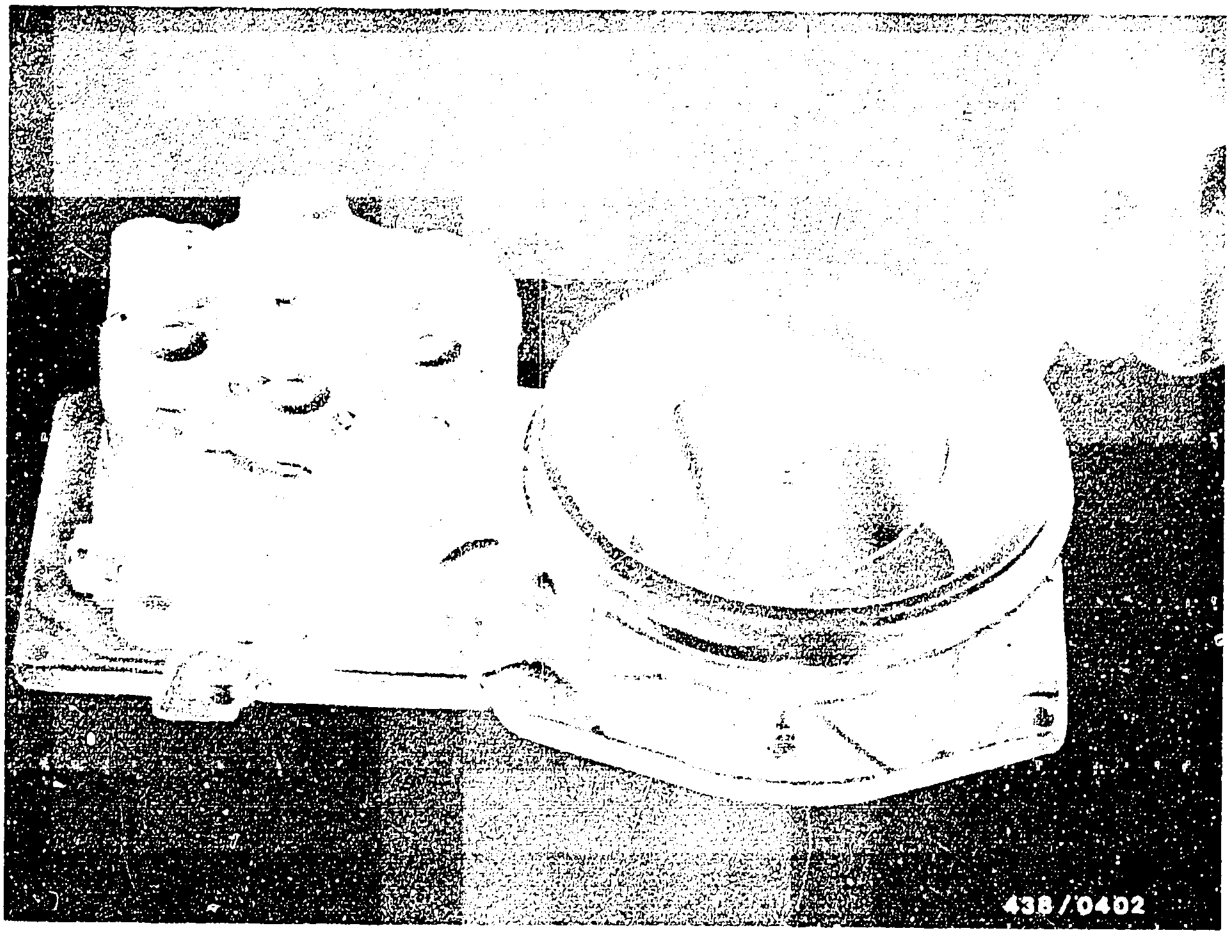
C A U T I O N !

Never lift the sensor flap with the engine running because fuel will be injected. Subsequent starting can lead to severe engine damage!



9.2 Checking main lever for freedom of movement

Lift the sensor flap by hand (updraft) and release. The sensor plate should spring back into its neutral position, bouncing once or twice off of its spring-loaded stop.
If the main lever does not move freely, first loosen all mounting bolts of the air flow sensor in order to determine if the problem is caused by housing stress.
If the sensor plate moves freely with the mounting bolts loose, replace the gasket between the air supply housing and the air flow sensor (Audi replacement part).
Retighten bolts diagonally with a torque of
9 ... 10 Nm (0.9 ... 1.0 kp/m).
If housing stress is not the problem, replace the air flow sensor.



9.3 Checking the control plunger for freedom of movement

Lift the sensor plate by hand (updraft).

Uniform resistance must be felt over the entire range of travel.

Push the sensor plate rapidly in the opposite direction, stopping just before the neutral position stop.

The control plunger should follow slowly, coming to rest against the sensor plate lever.

If this the case, movement of the control plunger is not impeded.

If the control plunger does not move freely, remove the fuel distributor from the air flow sensor.

Important !

When installing fuel system components and lines, observe the following:

Make sure the area around fuel system connections is clean when loosening or tightening them.
Dirt must be kept out of the fuel system.

When loosening or tightening fuel system connections, use a wrench to hold the components at their hexagonal surfaces.

Thoroughly clean the fuel distributor in the area of fuel system connections. Unscrew all connections.

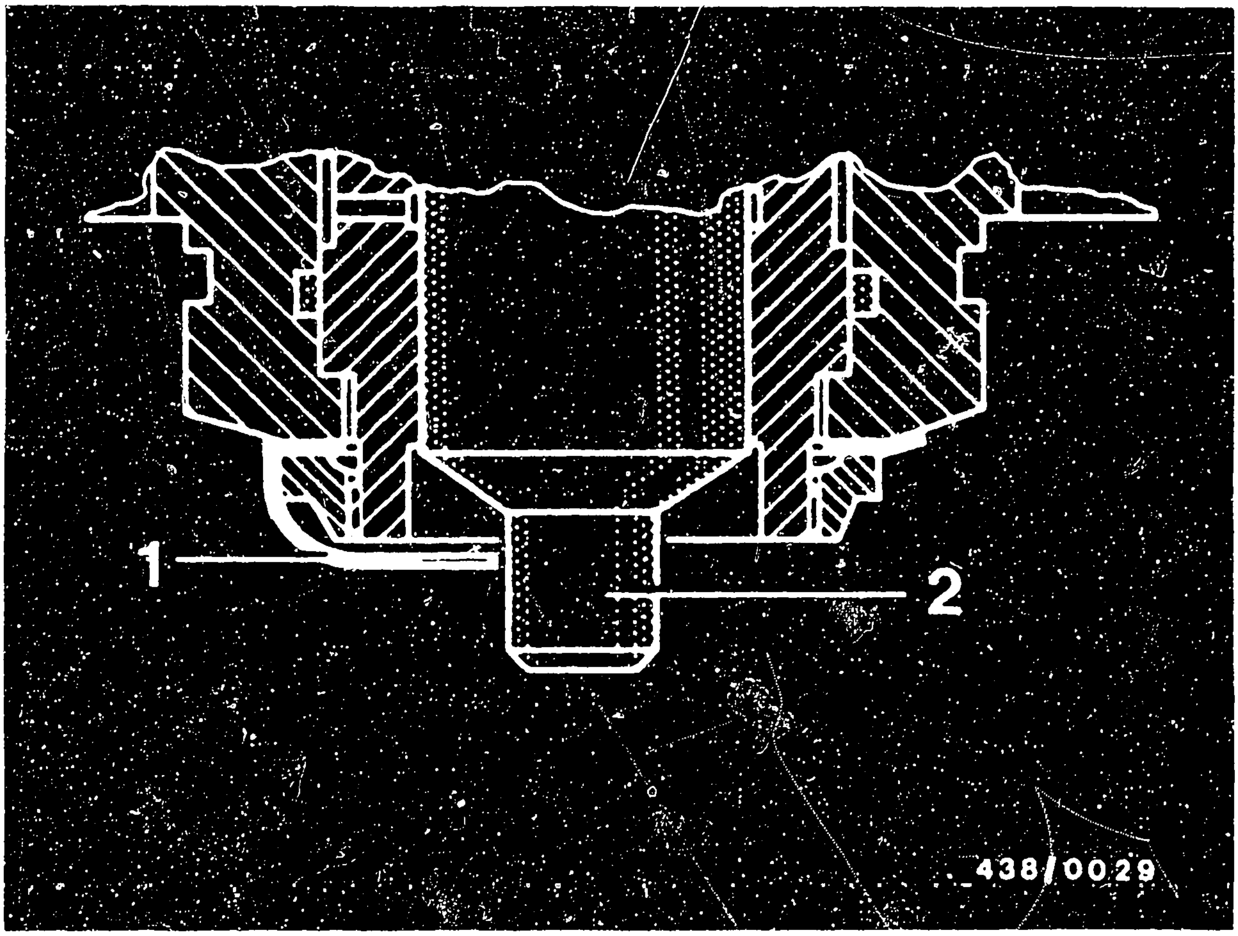
438/0028

Unscrew the three mounting bolts, and remove the fuel distributor from the air flow sensor.

Remove the control plunger. It may be necessary to blow compressed air briefly through the control pressure connection hole; hold the control plunger by hand. Clean the control plunger thoroughly using benzine. If freedom of movement is still not achieved, replace the fuel distributor.

Caution!

Fuel distributors are additionally equipped with a compression spring above the control plunger as well as a plunger retainer.
When removing the control plunger, first bend up the retainer while holding the compression spring in position. Do not forget to replace the spring when reassembling the fuel distributor.



1 = Plunger retainer 2 = Control plunger

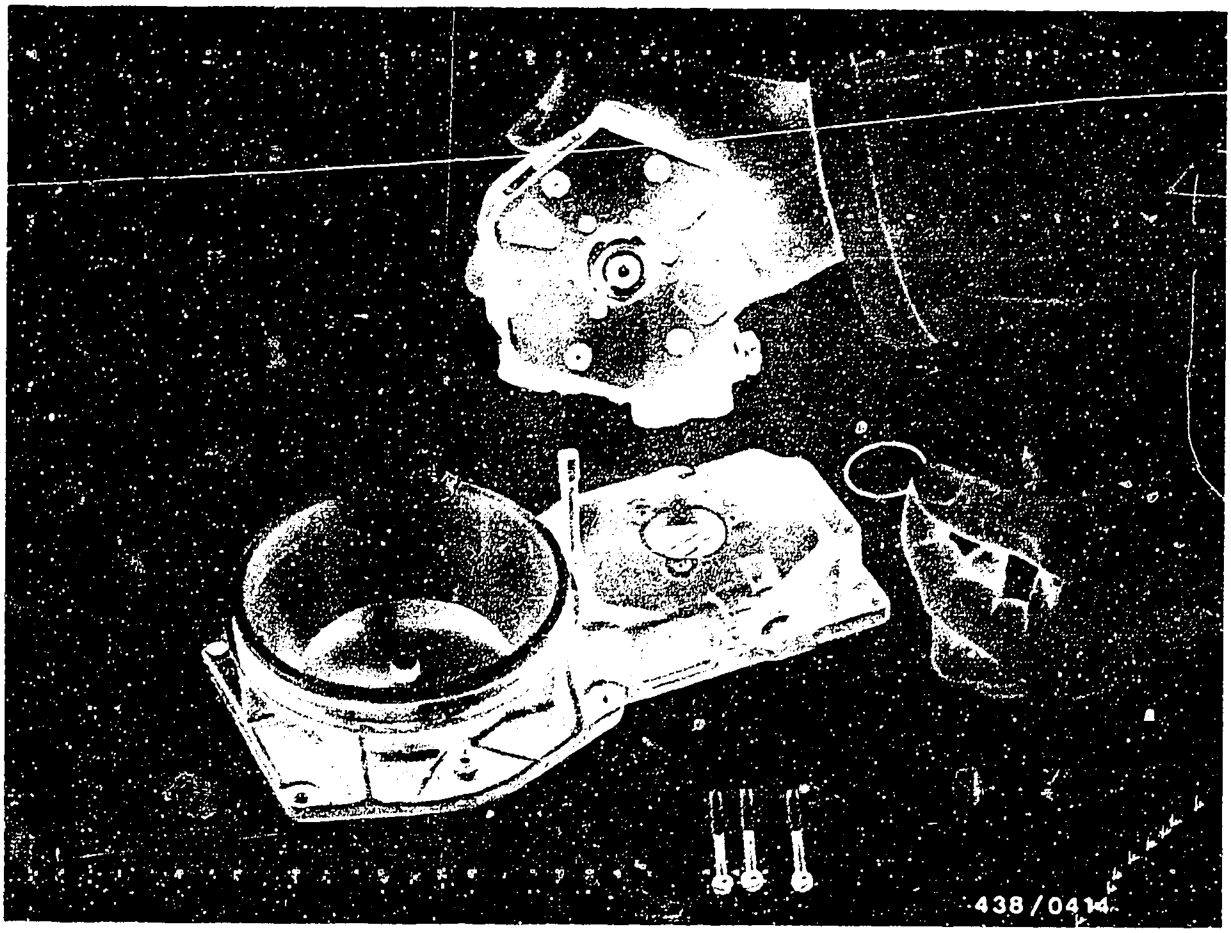
9.4 Fuel distributor with control plunger retainer

Caution!

Fuel distributors are equipped with control plunger retainers.

This sheet-metal tab also acts as a transport safety device and facilitates assembly.

Do not remove the plunger retainer!

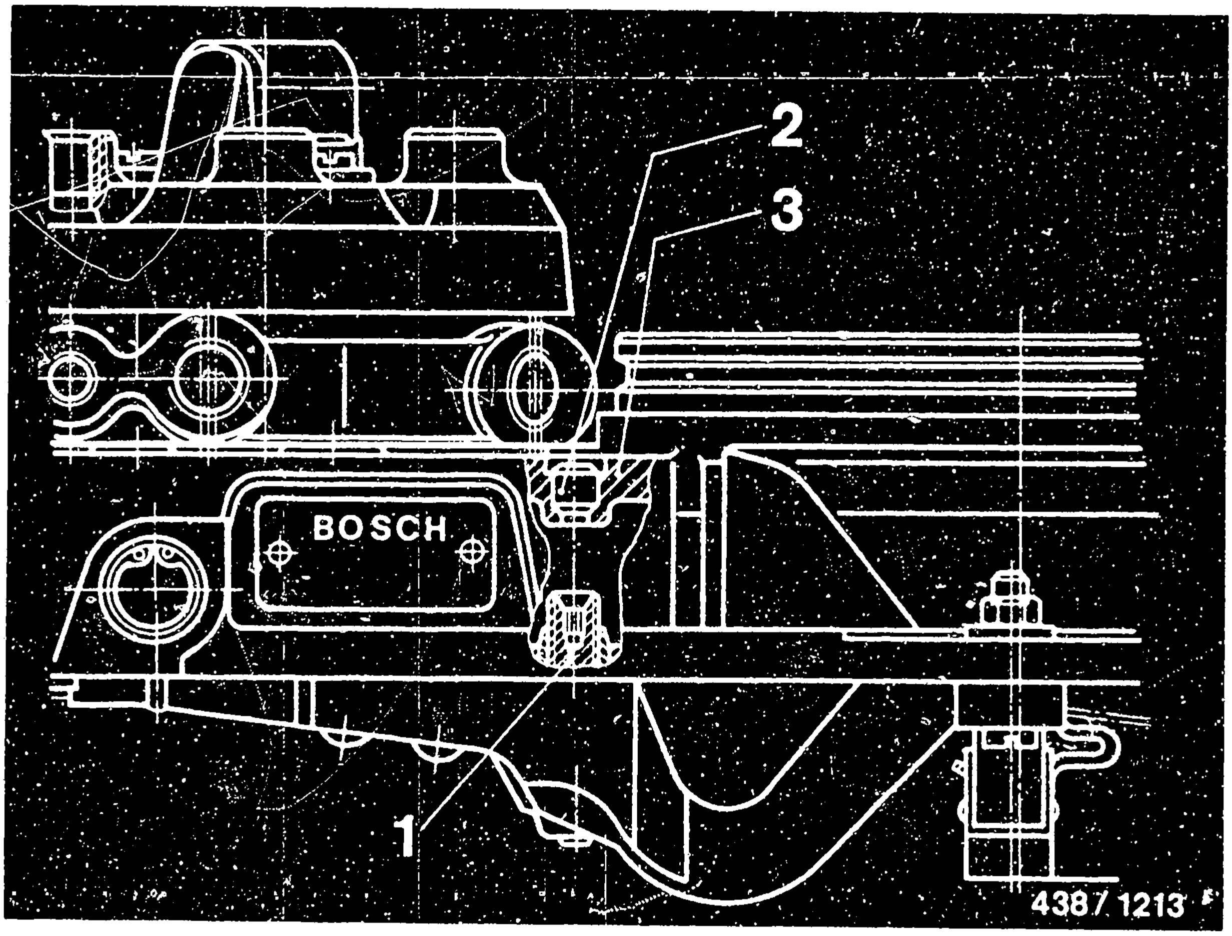


9.5 Fuel distributor installation

When installing the fuel distributor, replace the gasket between the distributor and the air flow sensor.

Strictly observe the tightening torque of 3.2 ... 3.8 Nm (0.32 ... 0.38 kp/m).

Use new seals when reconnecting the injection lines.



1 = Idle mixture screw
2 = Aluminum plug
3 = Air flow sensor

9.6 Position agreement of fuel distributor and air flow sensor prior to first start

- Fixing the idle mixture screw

The hole in the air flow sensor which provides access to the idle mixture screw has a pressed-in aluminum plug to prevent tampering. It can be removed using the same set of tools as required for removal of the ECE seal.

(e.g. No. 4521/7, Hazet Co., 5630 Remscheid, West Germany)

A steel tab is inserted at the bottom of the aluminum plug in order to prevent complete penetration by the pilot drill.

The aluminum plug has the following order number: 2 437 001 009.

- Setting the idle mixture screw

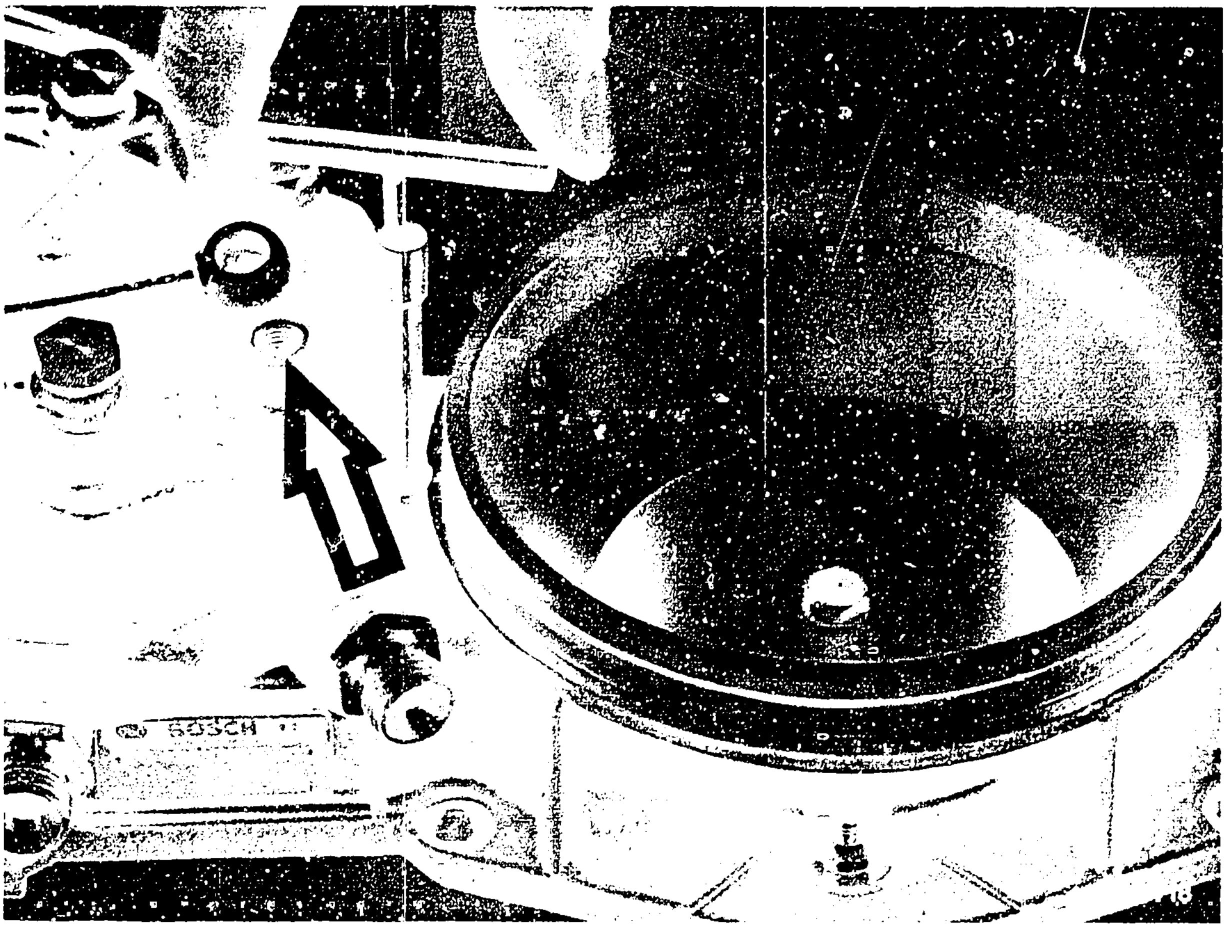
Unscrew one of the injection lines at the fuel distributor. Bridge the electrical safety circuit so that the electric fuel pump will operate.

The idle mixture screw can be set via the access hole in the air flow sensor.

Insert adjusting wrench KDEP 1035 into the idle mixture screw.

C A U T I O N !

Never lift the sensor flap with the engine running because fuel will be injected. Subsequent starting can lead to severe engine damage!



Without applying excessive pressure to the adjusting wrench, screw in the idle mixture screw slowly until fuel just appears at the open outlet (arrow) of the fuel distributor. Back off the adjusting screw 1/2 turn.

Reattach the fuel line to the fuel distributor, start the engine and bring up to operating temperature.

Final position agreement between the air flow sensor and the fuel distributor is achieved by then setting the idle speed of the engine at operating temperature.

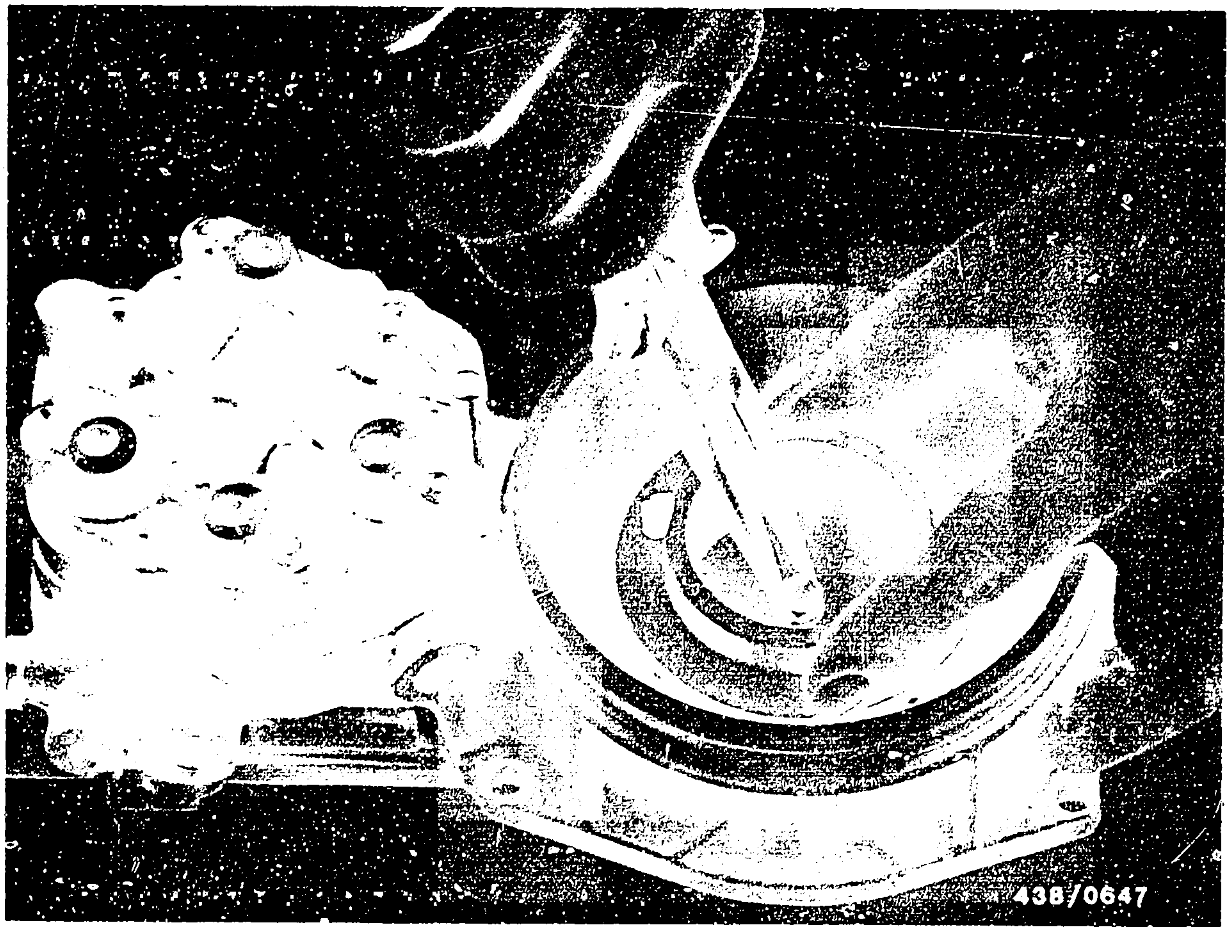
The idle adjustment procedure is explained at coordinates F 18.

10. Checking and adjusting sensor plate position

10.1 Preparations

- Engine temperature is not important.

- Remove the rubber cover between the air flow sensor and the throttle valve assembly (loosen two clamping bands) to provide access to the sensor plate of the air flow sensor.

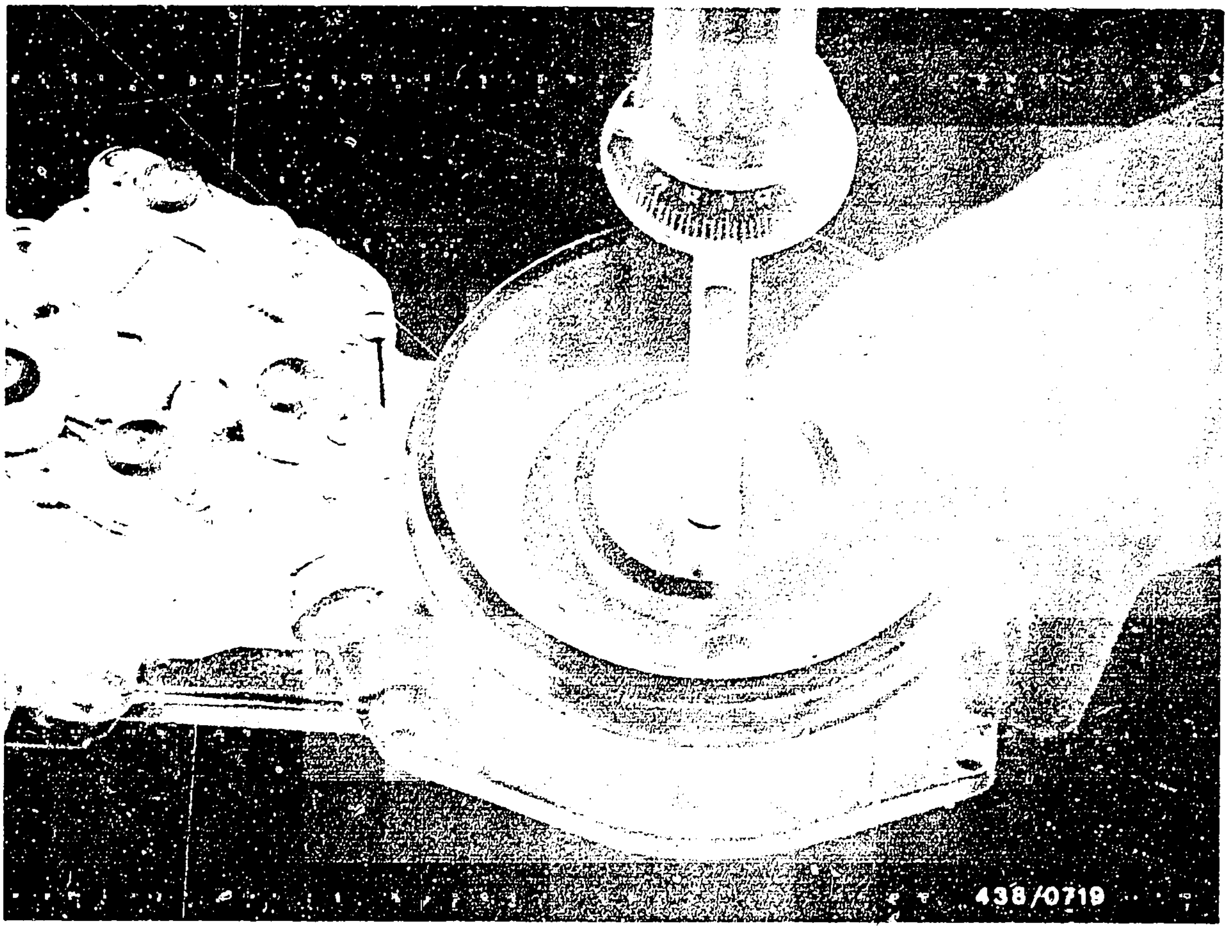


10.2 Centering the sensor plate

Check to make sure that the sensor plate is flat (not bent) and can move freely past the narrowest part of the cone. If necessary, center the sensor plate as follows using locating ring KDEP 1040/10 (dia. 80 mm):

Loosen the sensor plate mounting bolt.

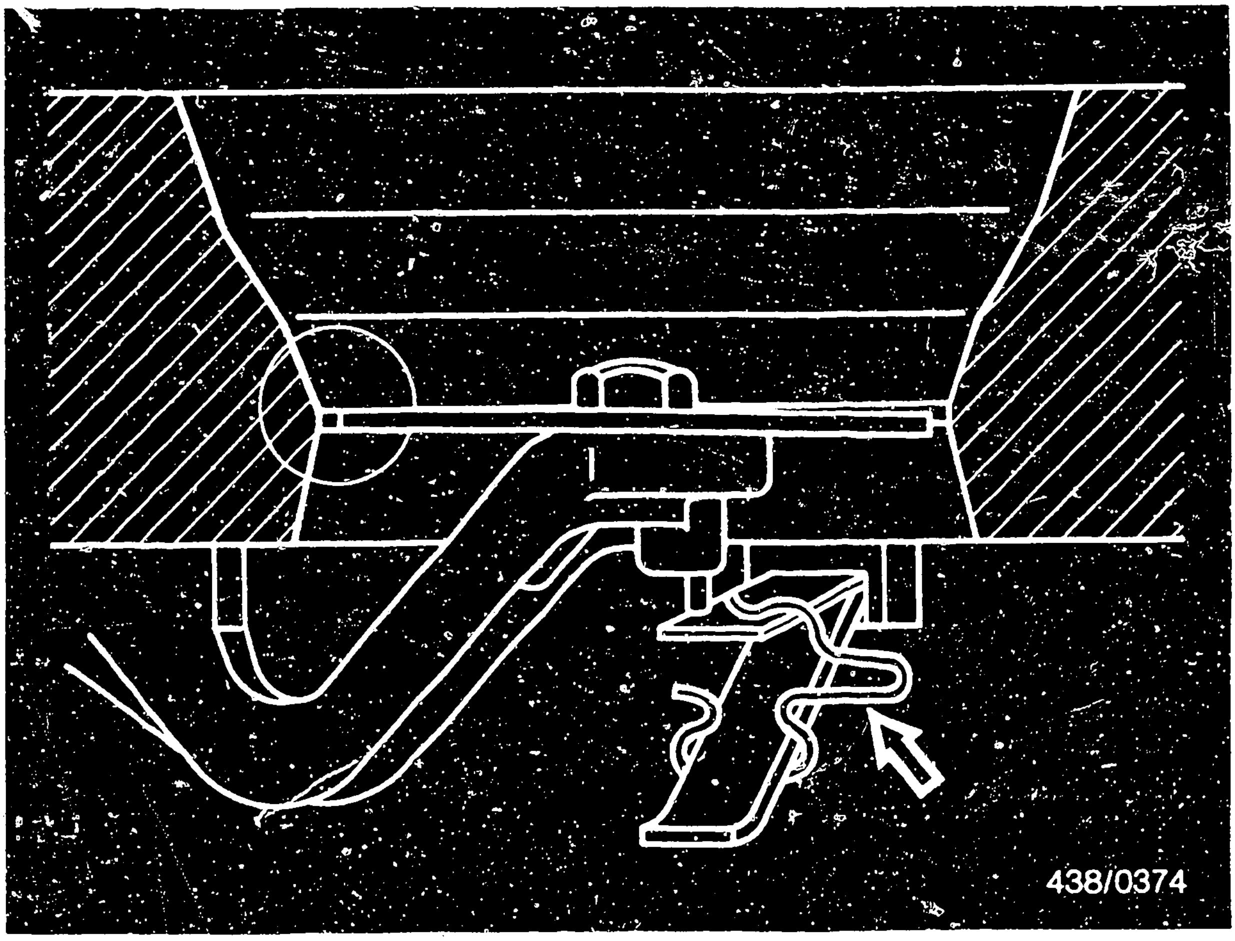
Insert the locating ring; hold the sensor plate in position by grabbing the mounting bolt with a pair of pliers so that the sensor plate does not deflect downward.



With the locating ring inserted, retighten the mounting bolt to a torque of 5.0 ... 5.5 Nm; loosen the mounting bolt again and retighten to the same torque.

When retightening the bolt, make sure that the sensor plate is in its neutral position (in the cylindrical part of the cone).

It must no longer be possible to turn the sensor plate by hand.

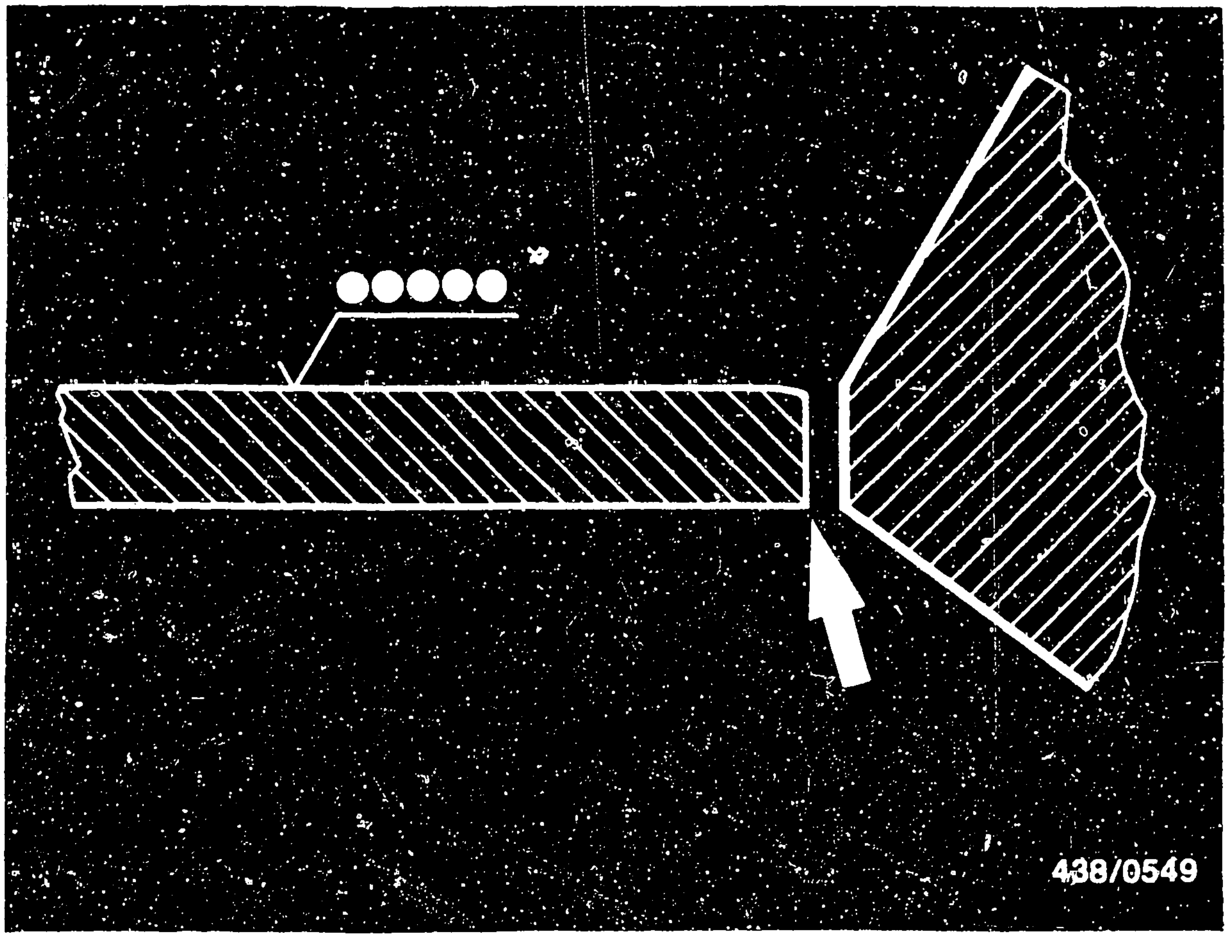


10.3 Checking and setting the neutral position of the sensor plate (rest position)

Run the electric fuel pump for approx. 10 seconds by bridging the safety circuit. This applies control pressure to the control plunger in the fuel distributor.

The top edge of the sensor plate must be flush with the cone at the position shown above (circle). The position of the sensor plate may be up to 0.5 mm lower, however the sensor plate may at no point on its circumference be outside the cylindrical part of the cone.

If necessary, the position of the sensor plate can be corrected by bending the spring (arrow).



C A U T I O N !

Make sure that the sensor plate is installed correctly!

- Air flow sensor 0 438 120 181

The top surface of the sensor plate is identified by a row of five punch marks.

The sensor plate is installed with the sharp edge (arrow) down.

- Air flow sensor 0 438 121 023

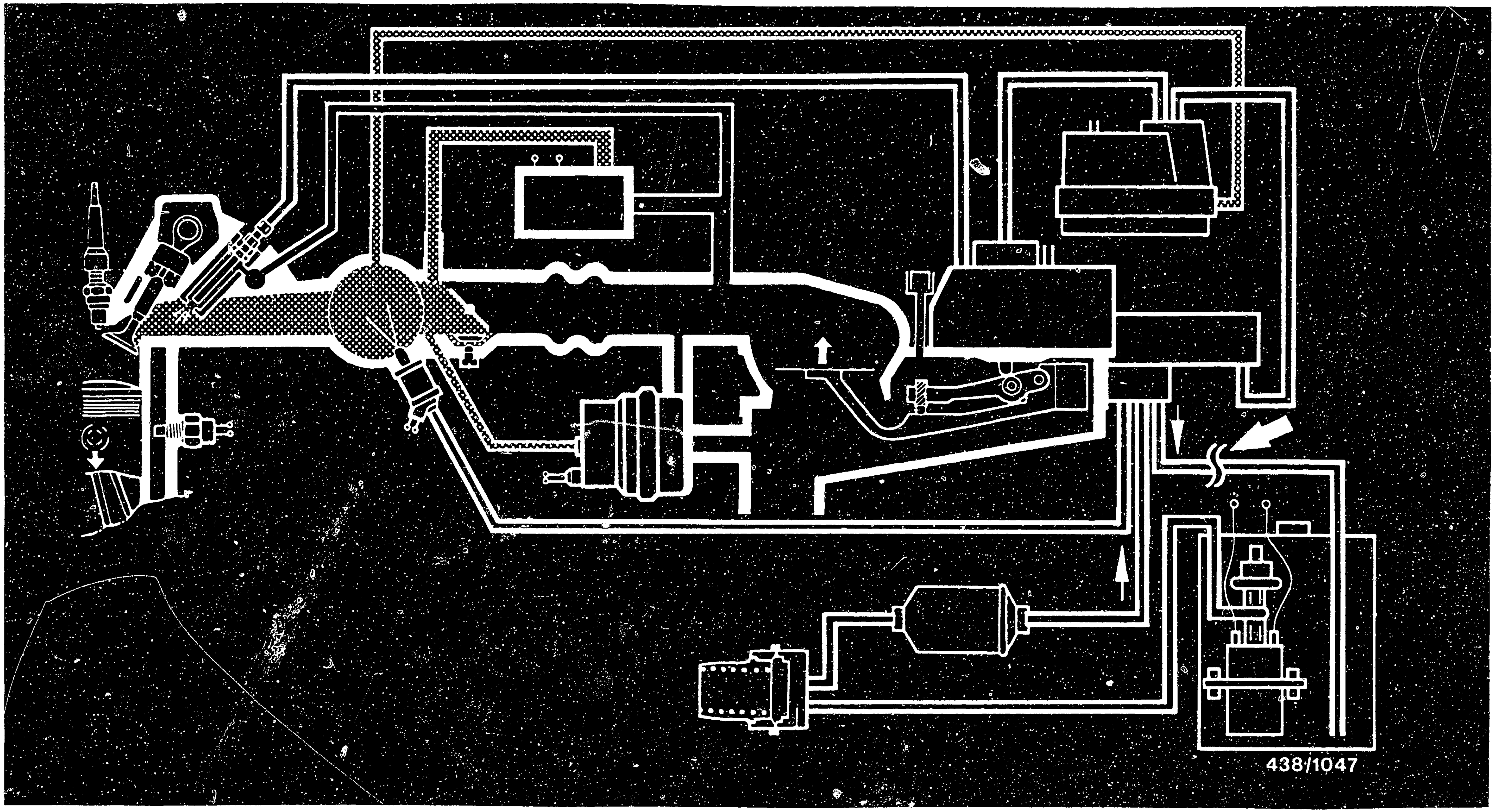
The circumference of the sensor plate is ground. This sensor can be installed either way up because both surfaces have sharp edges and neither surface is marked.

11. Checking operation of the auxiliary air device (does not apply)

The otherwise necessary check of the auxiliary air device does not apply to these Audi 5-cylinder models.

As of August 1982 these vehicles are equipped with an electronic idle speed stabilizer (not a Bosch product) instead of an auxiliary air device.

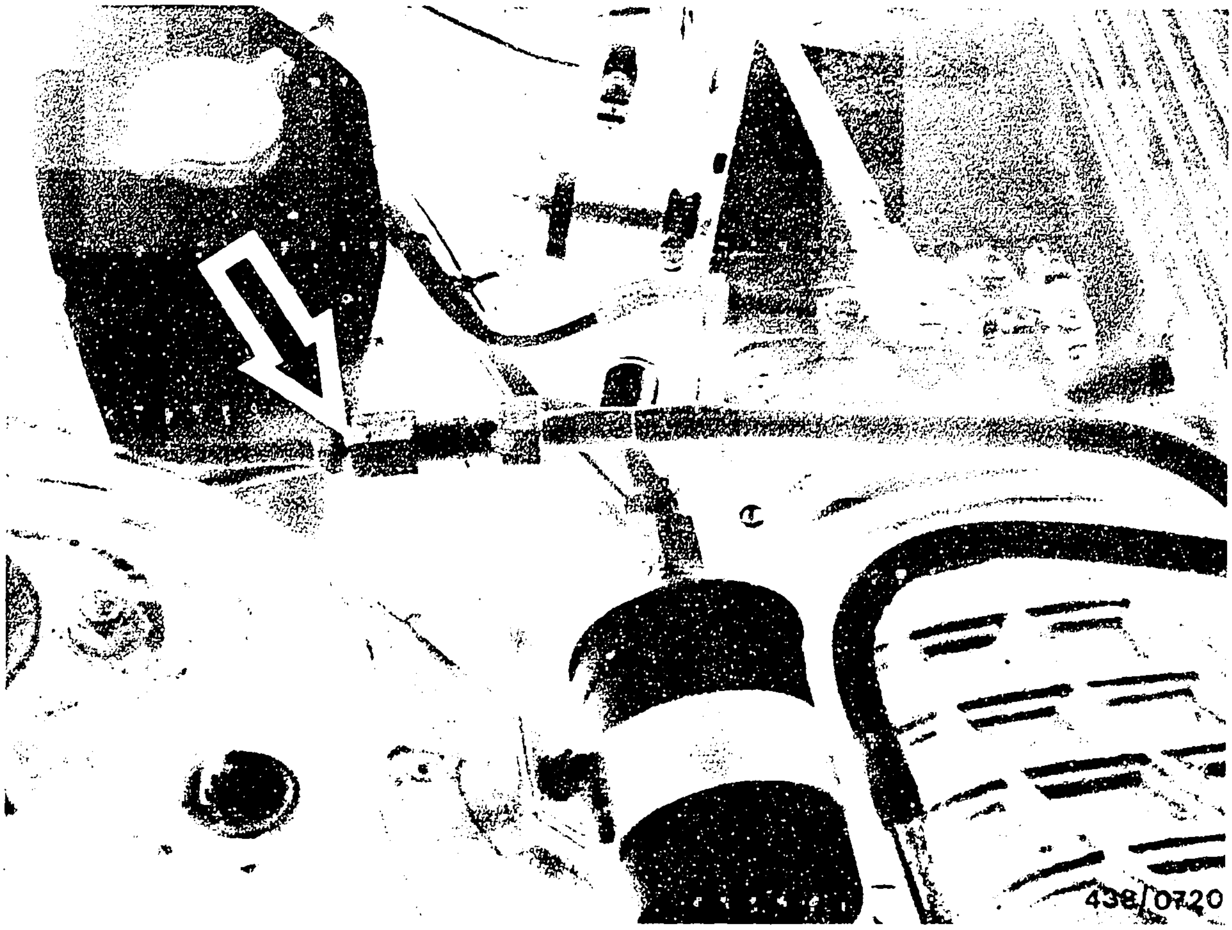
Section 22 (coordinates J 8) describes how to check this idle speed stabilizer.



12. Checking the operation of the electric fuel pump

12.1 Requirements

The best way of determining whether or not the electric fuel pump is operating correctly is to measure the delivery rate against pressure, i.e. against the primary pressure. This measurement must therefore be made at the return line to the fuel tank (arrow).



12.2 Test point

A suitable point for measuring the delivery rate is the fitting (arrow) in the return line to the fuel tank.

To make this measurement, hold the end of the hose in a graduate (approx. 1.5 l volume).

12.3 Measurement

Disconnect the lead from the warm-up regulator. Run the electric fuel pump for exactly 30 seconds by bridging the safety circuit and allow pump to discharge into the graduate.

CAUTION!

Never lift the sensor flap with the engine running because fuel will be injected. Subsequent starting can lead to severe engine damage!

12.4 Test value

Delivery rate: at least 850 cm^3/30 seconds

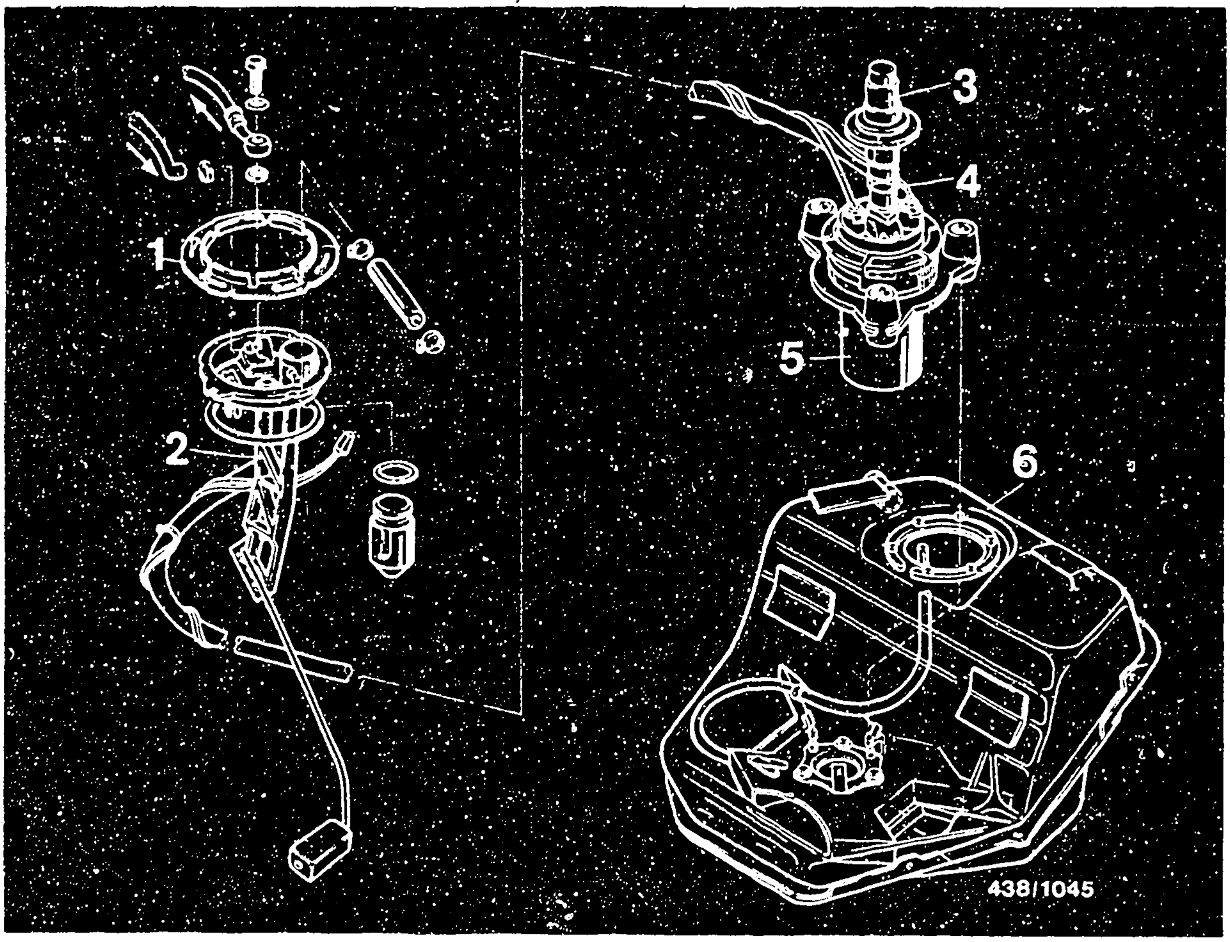
12.5 Possible causes of insufficient delivery rate

Voltage supply to electric fuel pump defective, voltage drop.
A required minimum volage of 11.5 V must be present at the closure ring connector (on the top of the fuel tank) with the electric fuel pump running.

Heavily contaminated fuel filter.

If the above points are in order, the cause of insufficient fuel delivery is the electric fuel pump itself.

Replace the electric fuel pump.

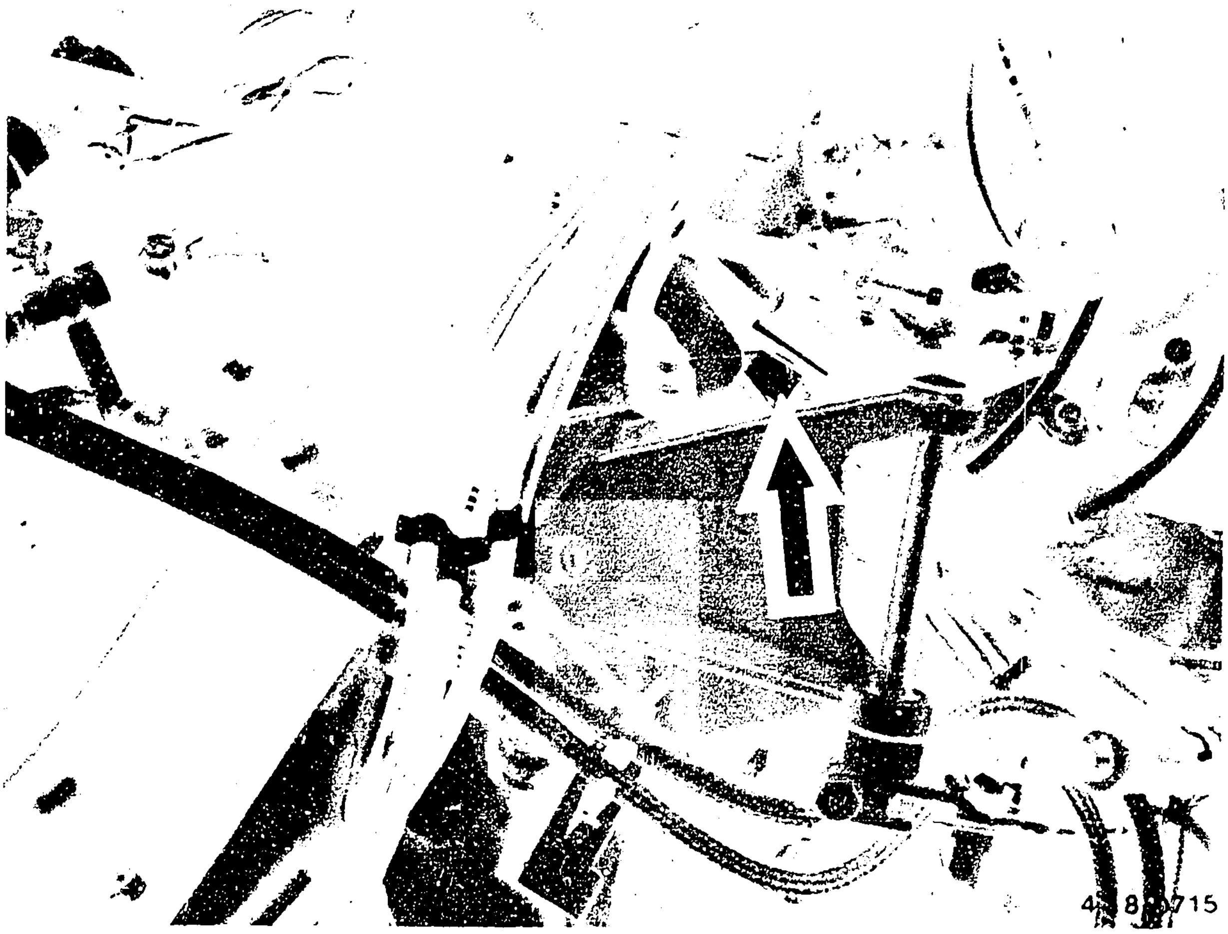


1 = Closure ring
2 = Pickup for fuel indicator
3 = Pressure damper
4 = Check valve
5 = Electric fuel pump
6 = Fuel tank

12.6 Removing and installing the in-tank electric fuel pump

Remove the closure ring and the fuel indicator pickup. Withdraw the entire fuel pump unit (electric fuel pump, check valve and pressure damper) from its spring clips on the bottom of the fuel tank.
Replace the electric fuel pump.

When installing the new pump, use a new gasket and make sure the electric fuel pump is in its proper position. Make sure that fuel lines are not crimped.

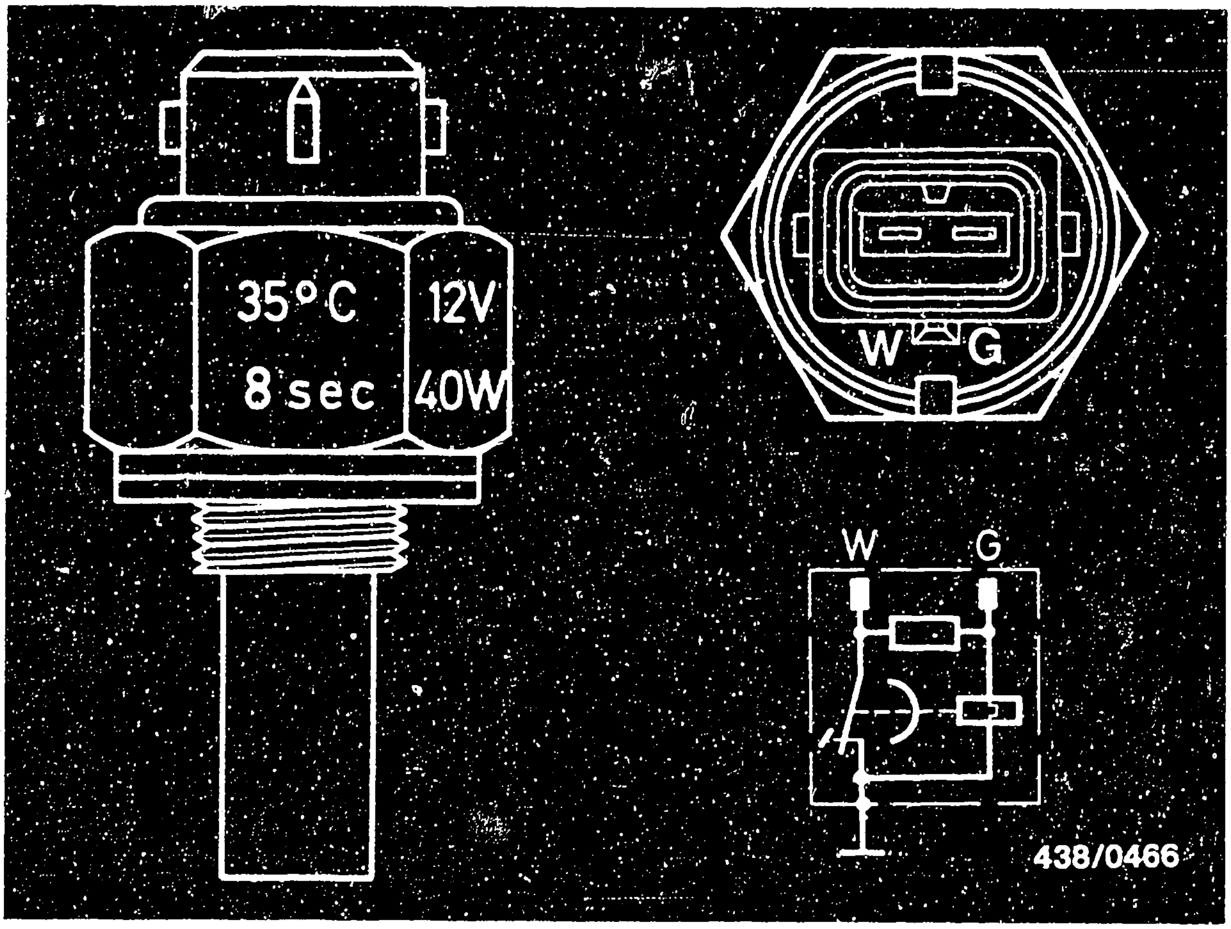


13. Checking cold-start system; thermo-time switch, cold-start valve, impulse relay

13.1 Thermo-time switch

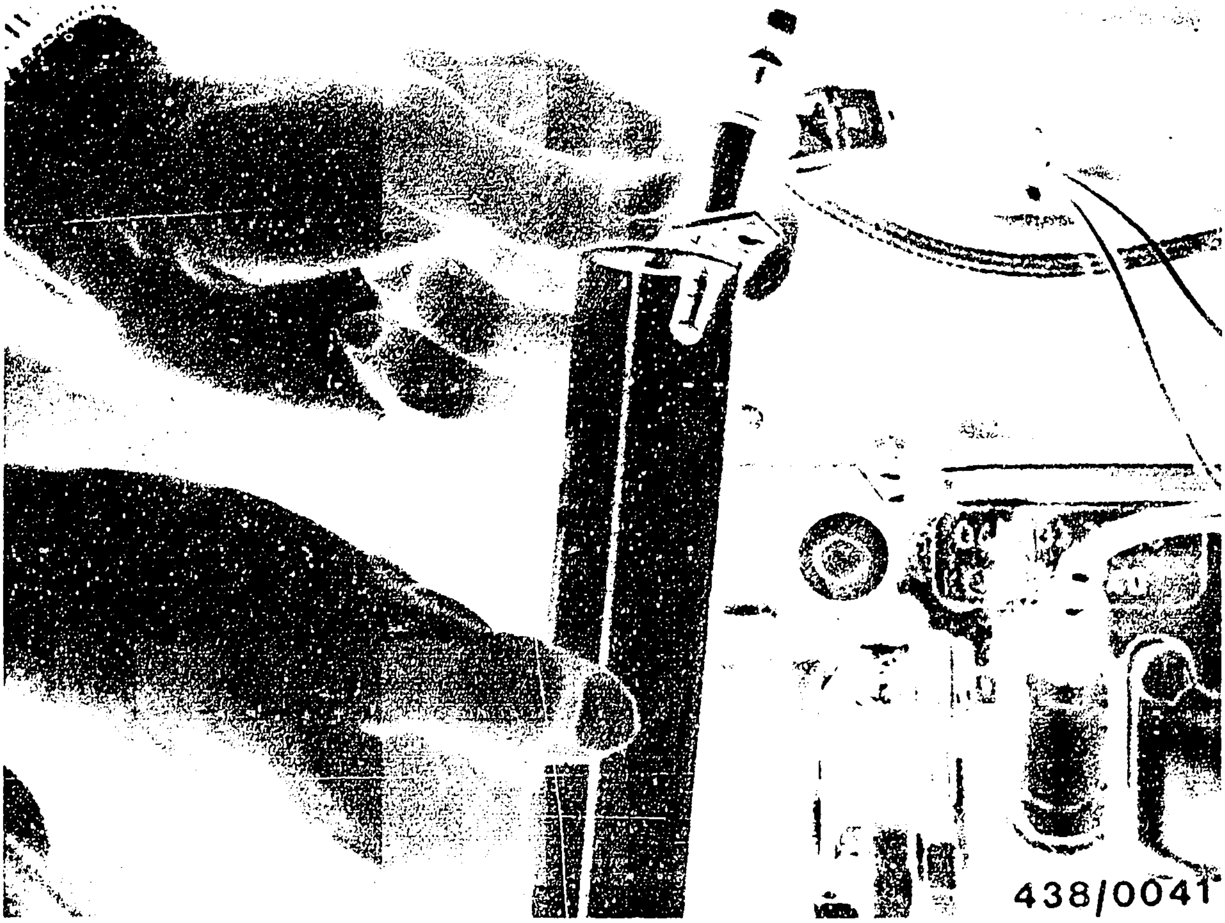
The thermo-time switch (arrow) is screwed into the cylinder head at the rear beneath the distributor.

It must be removed for checking.
Catch any escaping coolant in a suitable container.



The hexagonal surfaces of the thermo-time switch are stamped with the switching temperature +35°C and the switching time of 8 seconds at -20°C.
After removal, the thermo-time switch is checked using an ohmmeter in accordance with the values in the following table. The thermo-time switch can be easily brought up to temperature in a water bath and cooled down by placing it in the freezer.

		Resistance measurement between		
Temperature below °C	above °C	Term. "G" & "ground" (housing)	Term. "W" & "ground" (housing)	Term. "G" & term "W"
+30		25 ... 40 Ω	0 Ω	25 ... 40 Ω
	+40	50 ... 80 Ω	100...160 Ω	50 ... 80 Ω



13.2 Cold-start valve

Remove the valve to check; leave fuel line connected. Disconnect electrical lead and connect cold-start valve directly to ground and terminal 15 (i.e. at the ignition coil) using lead KDJE 7450/70.

Important note:

Do not touch lead to B +; sparks could ignite fuel!

Hold start valve in suitable container (e.g. graduate).

Run the electric fuel pump by bridging the safety circuit.
Switch on ignition (max. 30 seconds). The cold-start valve must now open and spray.

C A U T I O N !

Never lift the sensor flap with the engine running because fuel will be injected. Subsequent starting can lead to severe engine damage!

Switch off ignition, remove electrical lead and dry off valve nozzle.

Leave the safety circuit bridged so that primary pressure continues to be applied to the valve.

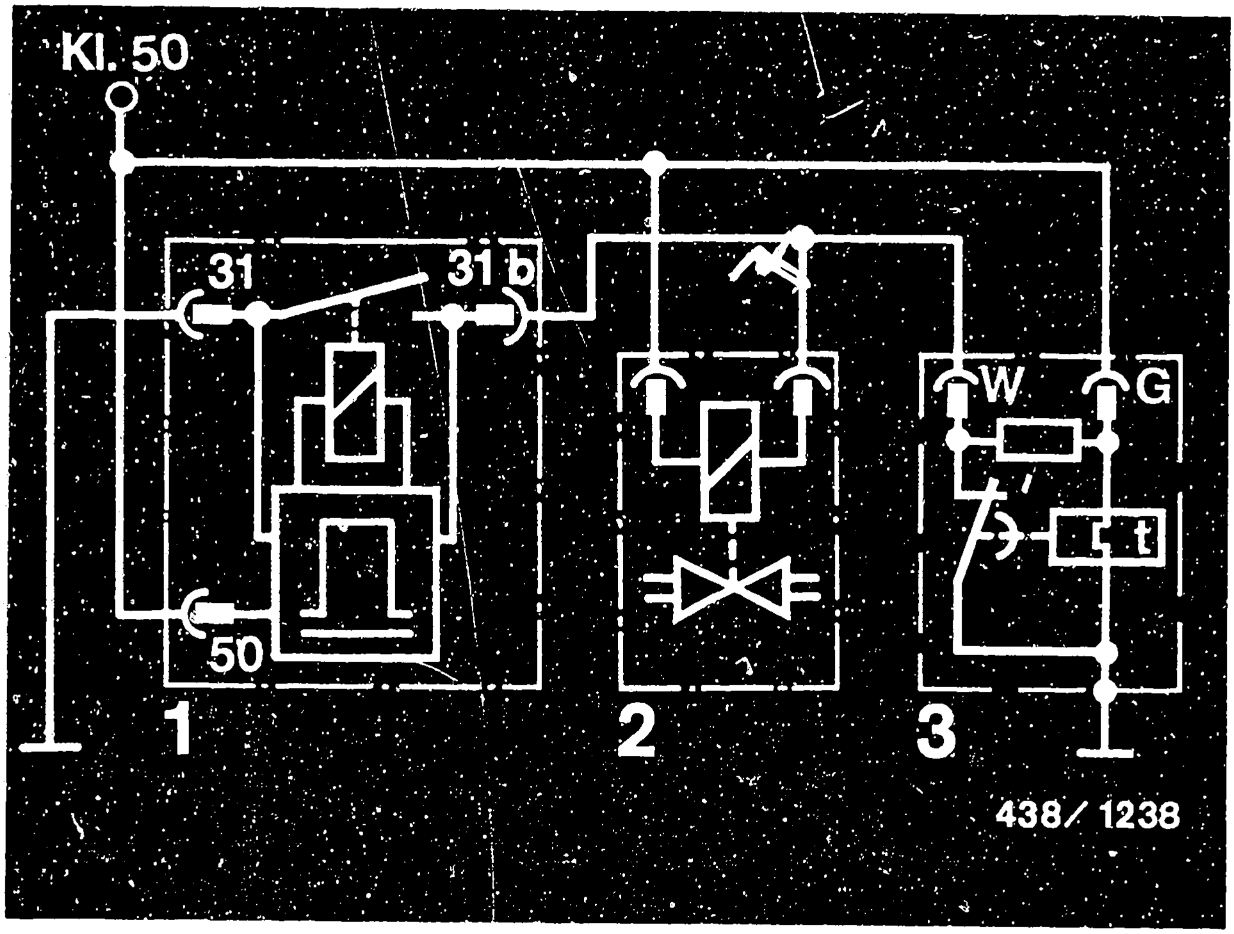
For a full minute no drops may form on the valve nozzle. The valve must remain leak-tight even when shaken and tapped.

Now switch off the electric fuel pump.

Replace the cold-start valve if it failed to open or was not leak-tight.

If the cold-start valve was replaced because it was not leak-tight or the thermo-time switch was replaced because it did not open, the idle speed must now be set with the engine at operating temperature.

The idle speed adjustment procedure is explained at coordinates F 18.



1 = Impulse relay
2 = Cold-start valve
3 = Thermo-time switch

13.3 Impulse relay for warm starting

The relay is electrically checked at an engine temperature greater than +40°C.
Disconnect the lead from the cold-start valve and connect a multimeter in its place. Select a voltage range of approx. 10 V.
The multimeter must now indicate voltage impulses when the engine is started.
If this is not the case, or if the meter indicates continuous voltage, replace the impulse relay.

14. Checking control pressures

14.1 Preliminary remarks:

The following control pressures to be checked are determined by the warm-up regulator.
However, faulty results can also be caused by problems elsewhere than in the warm-up regulator.

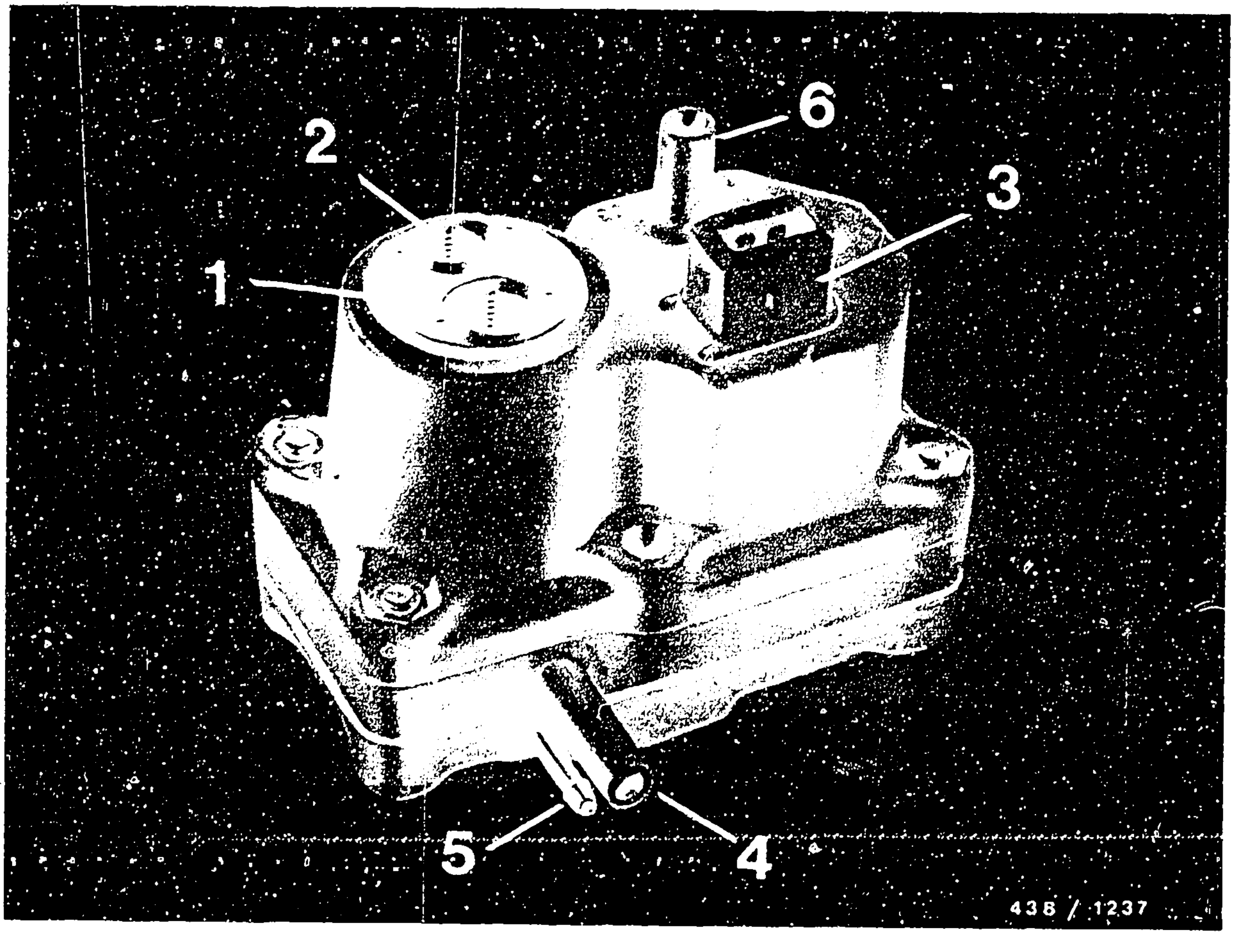
These possible faults are:

- Voltage absent or too low at connector plug.
- Fuel return line from warm-up regulator blocked or restricted.
- Fuel delivery rate too low or too high for the control pressure circuit

The checking of these control pressures is described as an additional step at the beginning of the control pressure tests.

Test value: 160 ... 240 cm^3/min

The other possible faults are discussed in their own test sections.

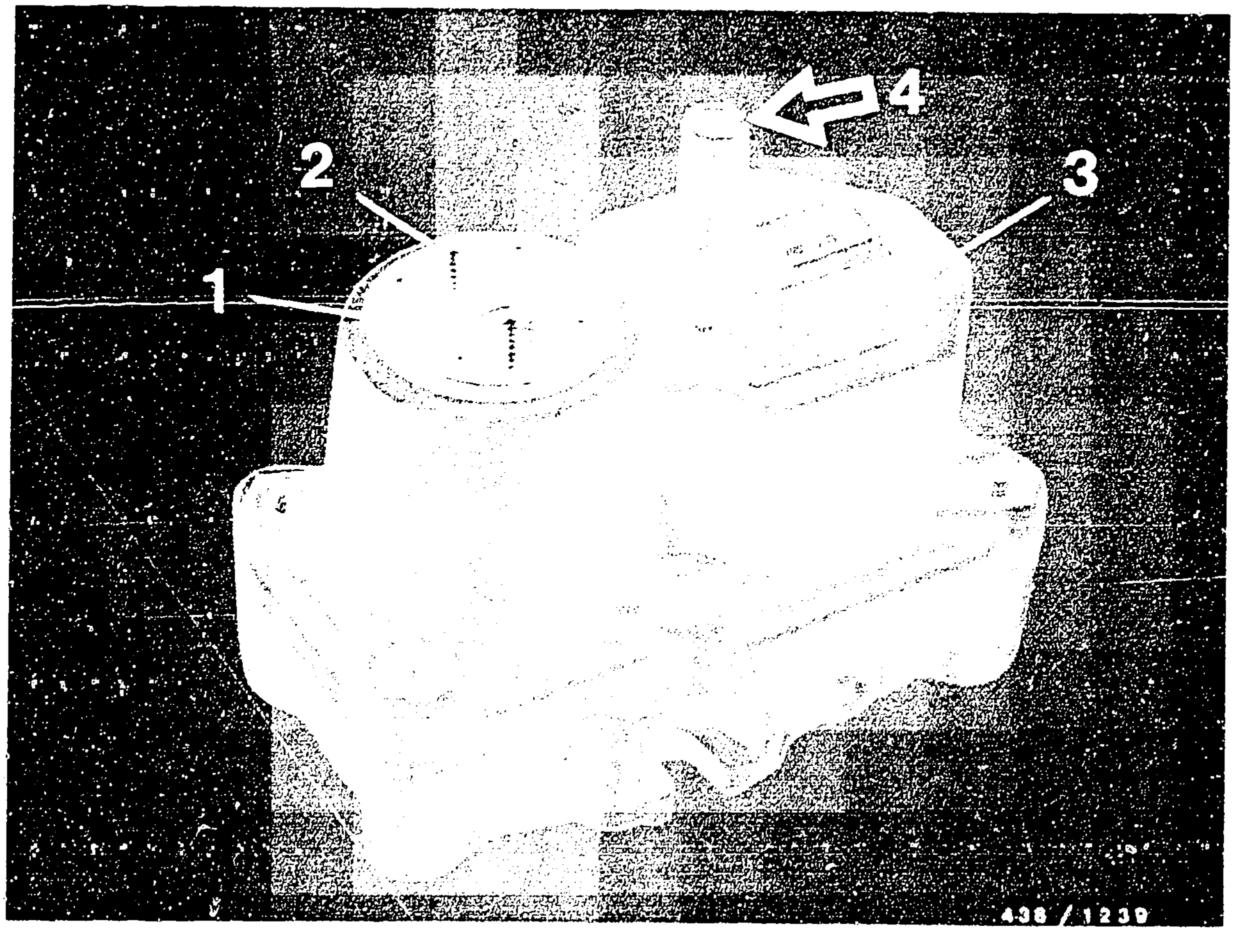


1 = Supply connection (M 10 x 1)
2 = Return connection (M 8 x 1)
3 = Electrical connection
4 = Manifold pressure connection (downstream of throttle valve)
5 = Connection for fixed restrictor
6 = Atmospheric pressure connection

14.2 Warm-up regulator designs

- 0 438 140 094/ ... 095

This warm-up regulator is designed for acceleration enrichment; the cold and warm control pressures are additionally influenced by the manifold pressure acting on the acceleration diaphragm of the warm-up regulator.

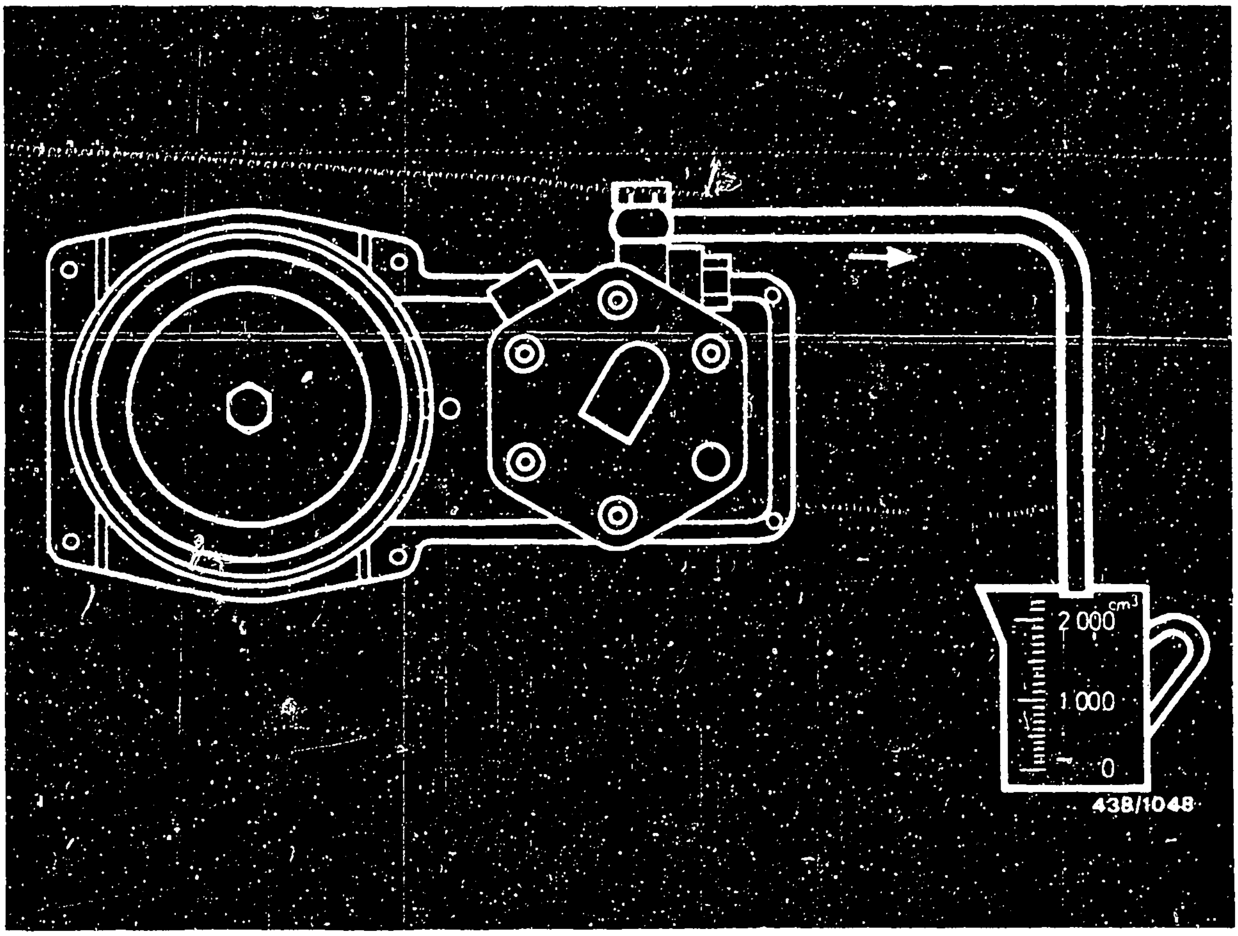


1 = Supply connection (M 10 x 1)
2 = Return connection (M 8 x 1)
3 = Electrical connection
4 = Atmospheric pressure connection

- 0 438 140 130/ ... 131

This warm-up regulator is designed for altitude compensation.

The cold and warm control pressures are additionally influenced by atmospheric pressure which acts on the altitude capsule of the warm-up regulator.
The atmospheric pressure connection (arrow) is located on the top of the regulator housing cover.
The regulator is connected to the engine upstream of the throttle valve.

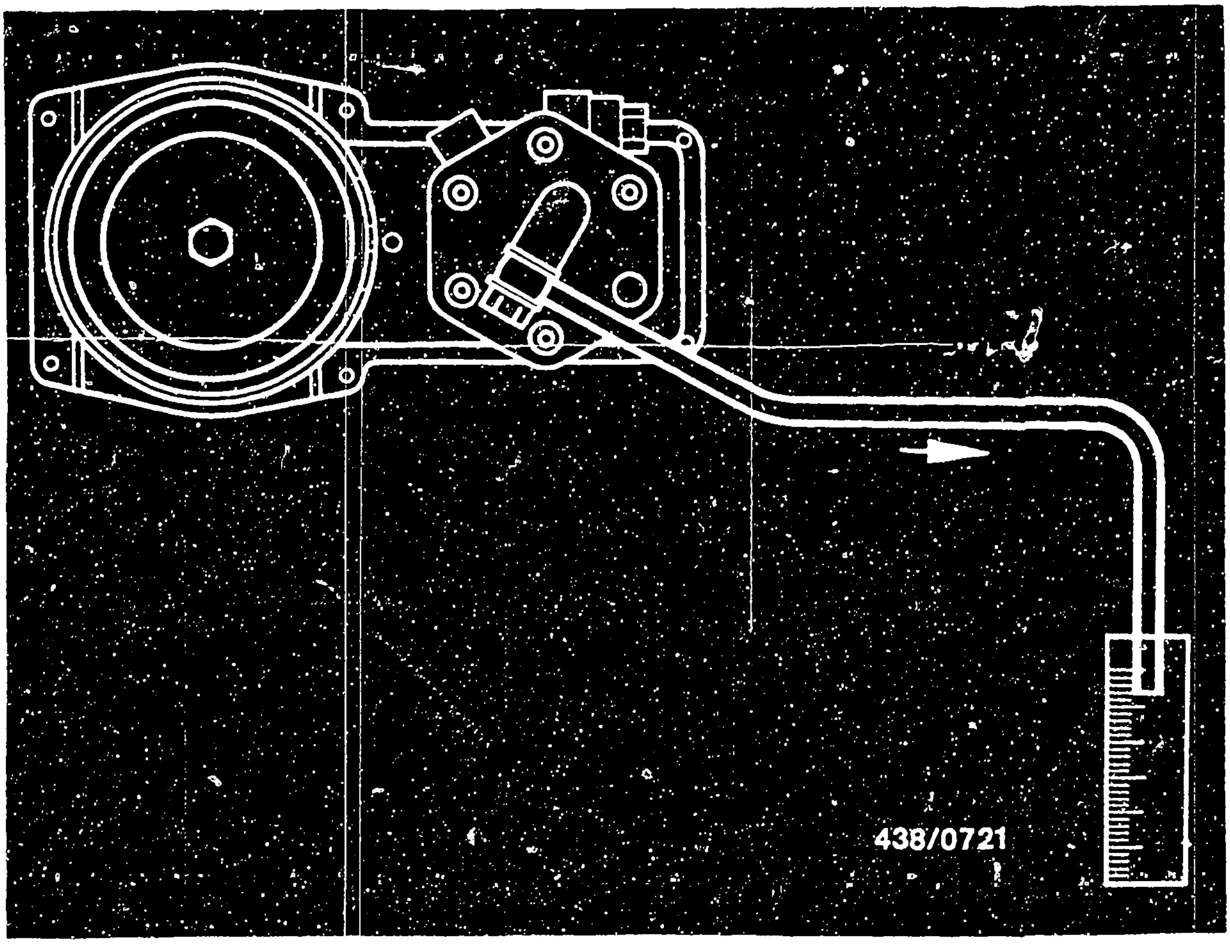


14.3 Checking the fuel delivery rate for the control pressure circuit

Test requirement: The electric fuel pump must be in good working order.

Test value: at least 850 cm^3/30 s

Use the fitting in the fuel return line to the fuel tank as the test point.



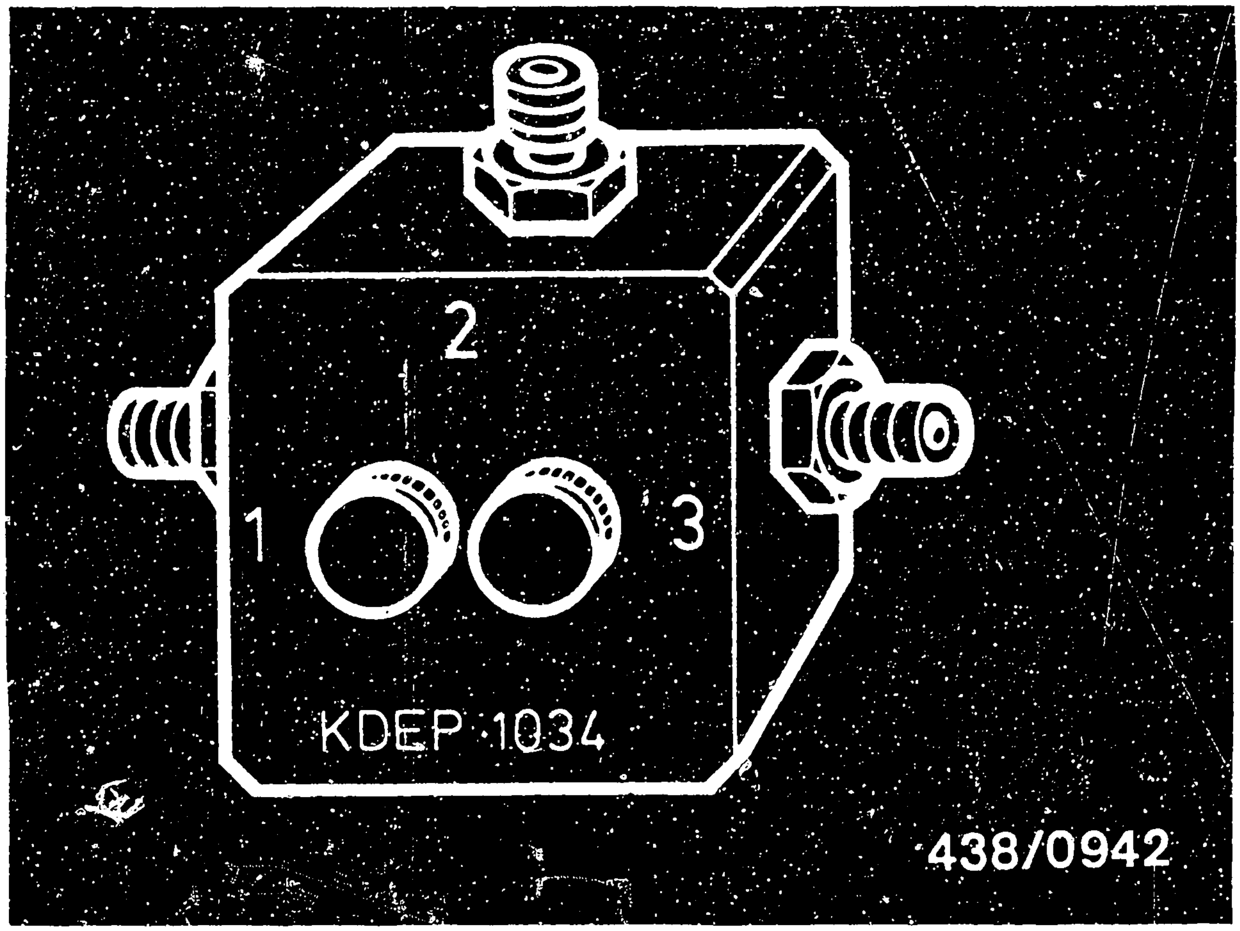
Unscrew the control pressure line from the fuel distributor at the warm-up regulator and hold the end of the line in a graduate (approx. 0.5 l volume).

Run the electric fuel pump for exactly 1 minute by bridging the electrical safety circuit, and measure the amount of fuel delivered.

Test value: 160 ... 240 cm^3/min

If the measured value is out of tolerance, the fuel distributor is defective.

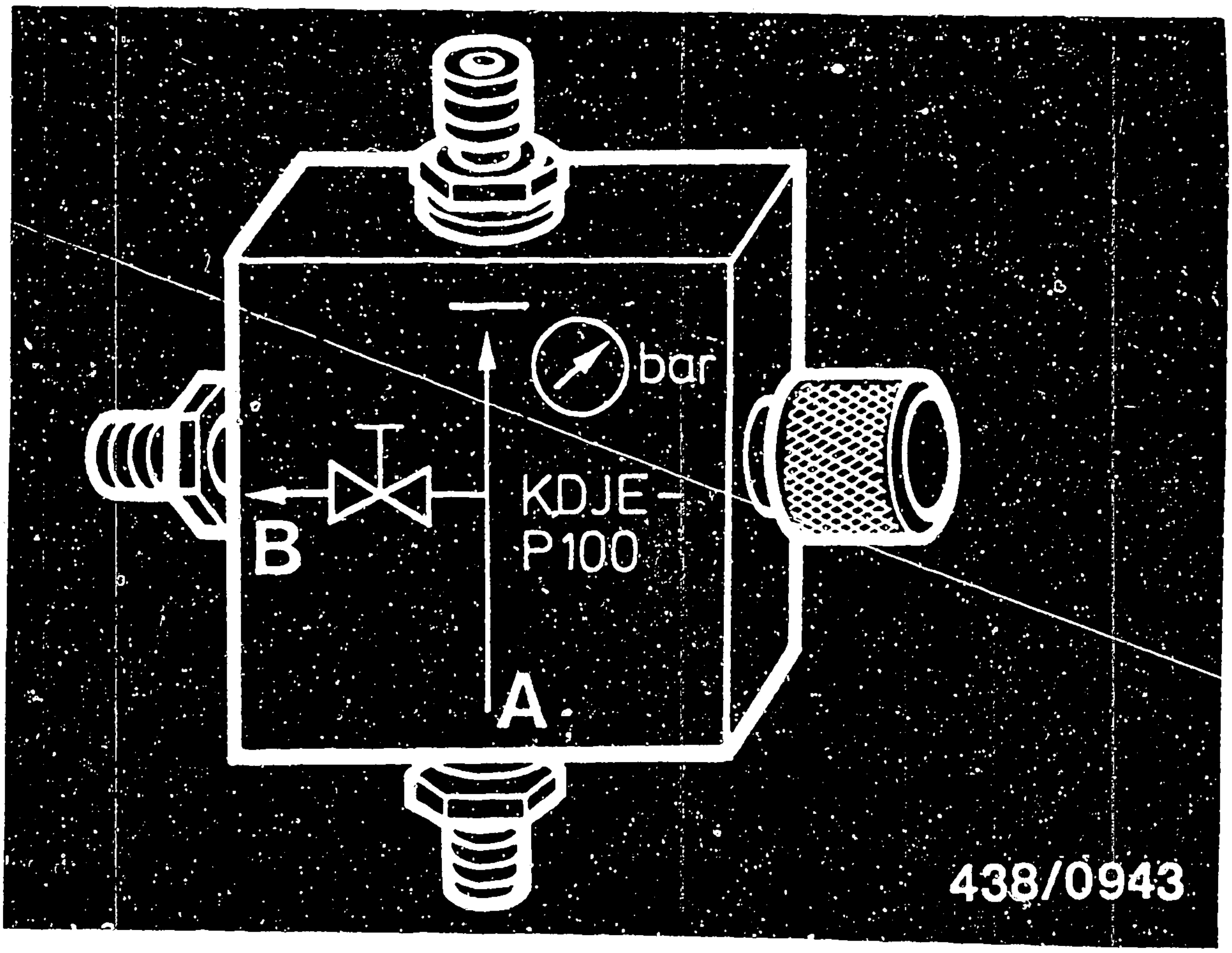
Replace the fuel distributor.



14.4 Attachment of pressure tester KDJE-P 100 (formerly KDEP 1034):

- Pressure tester KDEP 1034 comprises a three-way valve with two separate valve screws.

The ports of the directional control valve are numbered.



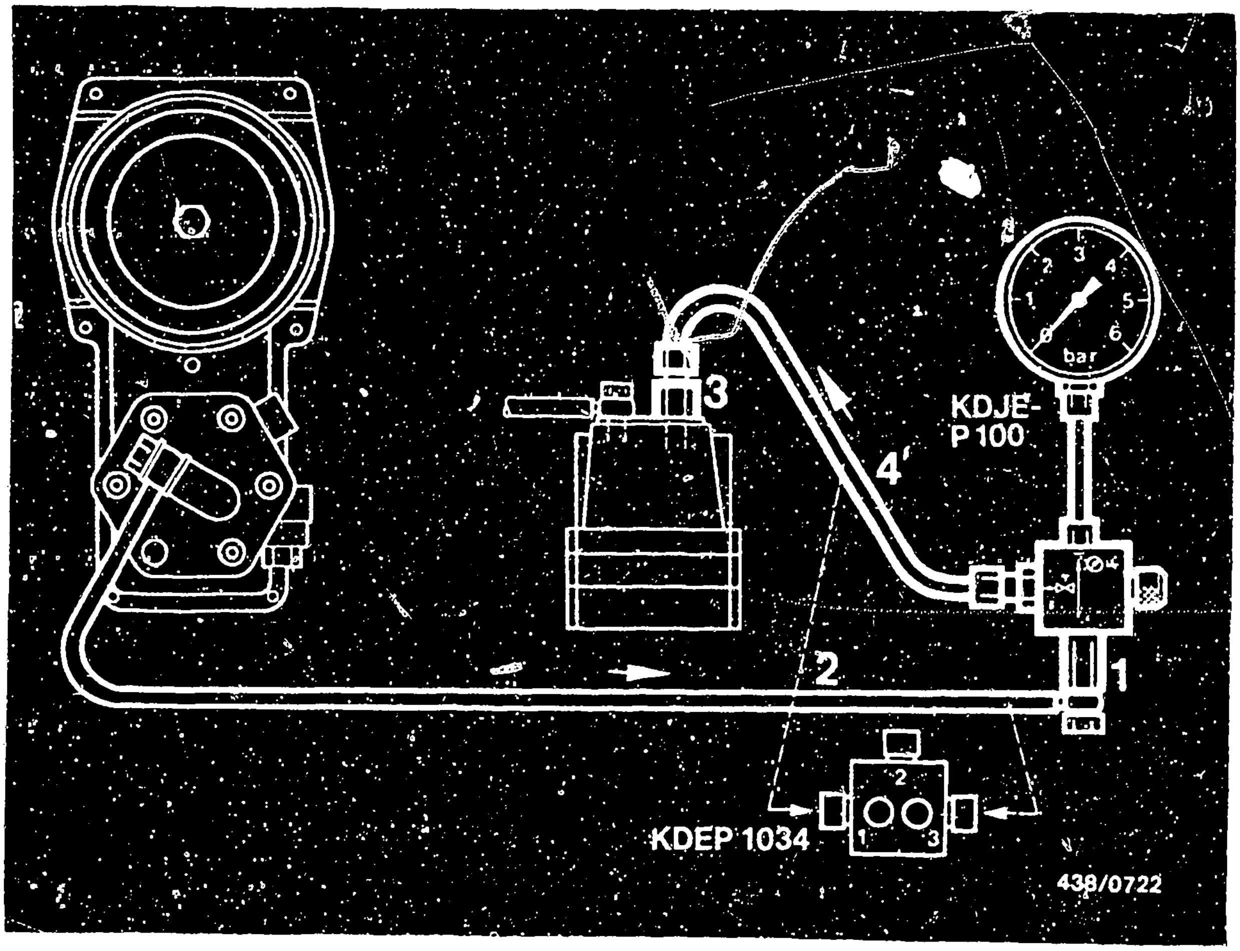
Since the end of 1979, pressure tester KDJE-P 100 has a directional control valve with only one valve screw. The ports of this directional control valve are graphically indicated on the side of the unit:

A = Inlet (from fuel distributor)

B = Outlet (to warm-up regulator)

Caution!

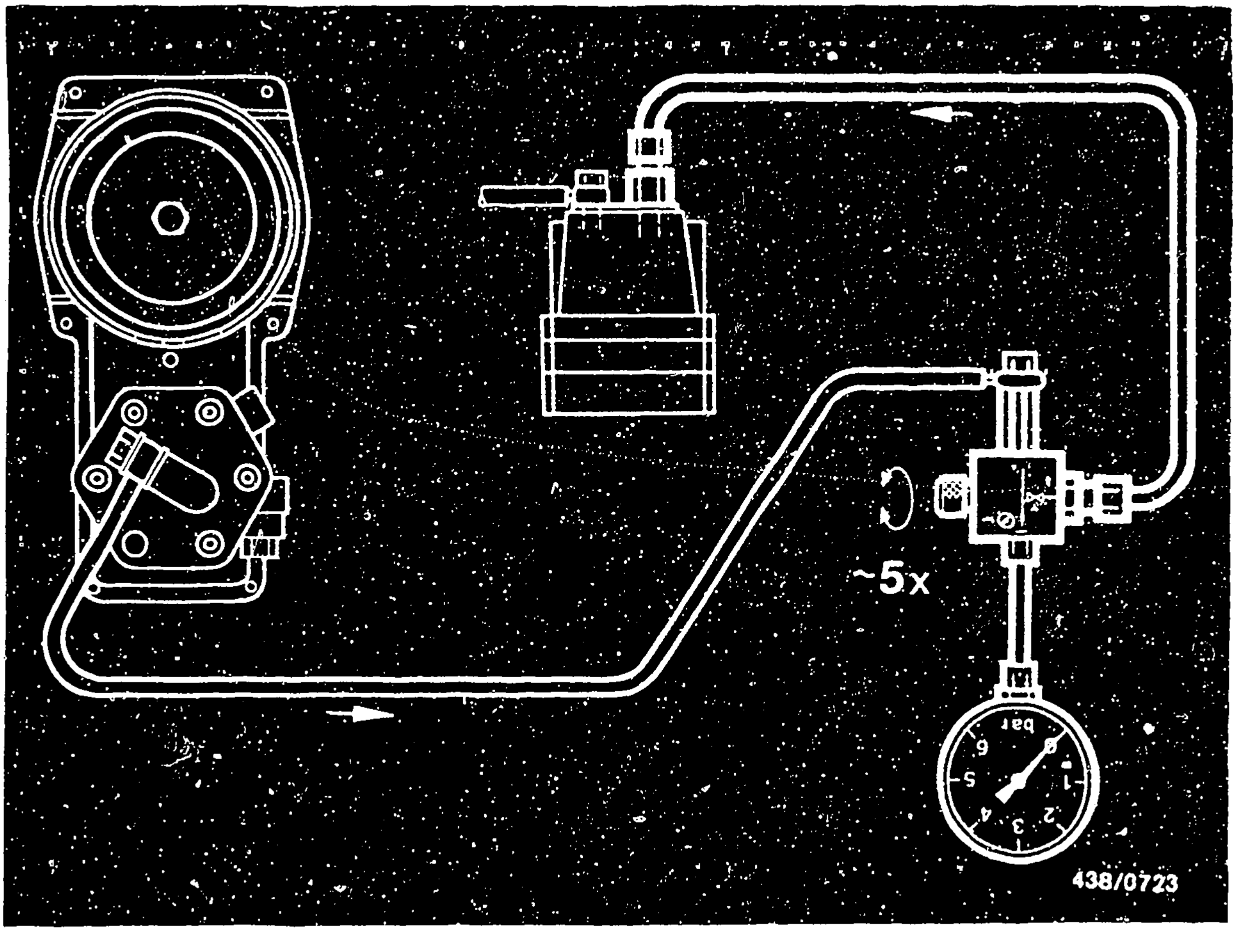
When the directional control valve is not in use, always leave the valve screw(s) open to relieve the seals.



The directional control valve of the pressure tester is placed in the control pressure line between the fuel distributor and the warm-up regulator.
Install the tester using connecting parts set KDJE-P 100/12.

- Screw adapter (1) with seal into inlet nozzle A or 3 of the directional control valve.
- Unscrew control pressure line (2) from the warm-up regulator and connect this line to adapter (1) using a hollow bolt of size M 10 x 1 and seals.
- Screw connector (3) of the connecting parts set into the inlet of the warm-up regulator and connect to outlet nozzle B or 1 of the directional control valve using hose (4).

Hang pressure gauge on hood (using a wire hook if necessary).



14.5 Bleeding the pressure tester:

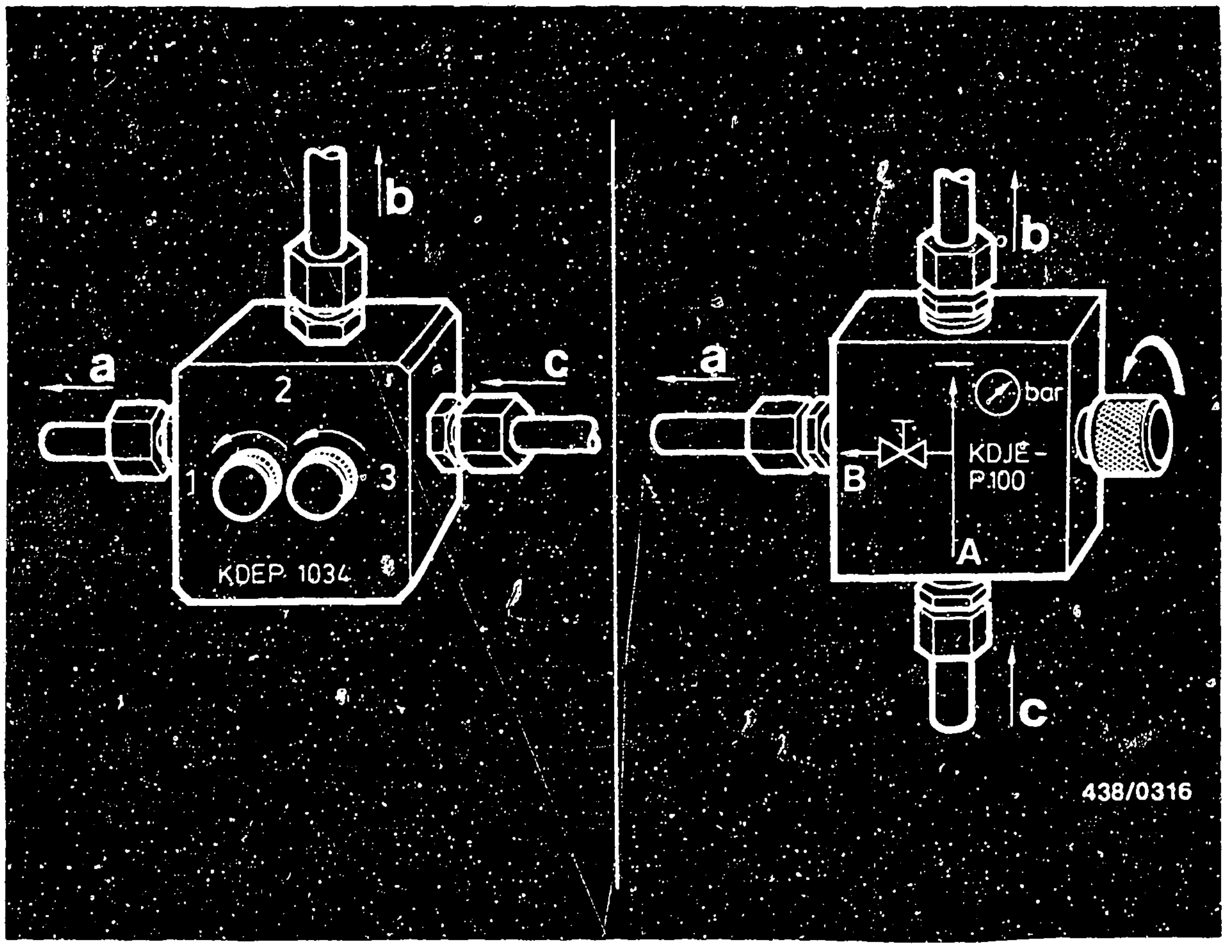
Unplug the electrical connector from the warm-up regulator. Allow the pressure gauge to hang downward so that the connecting tubing is straight.

Run the electric fuel pump by bridging the electrical safety circuit.

Open and close the valve screw(s) of the directional control valve approximately 5 times at 10-second intervals.

Then hang the pressure gauge in a suitable place (e.g. on one of the hood braces).

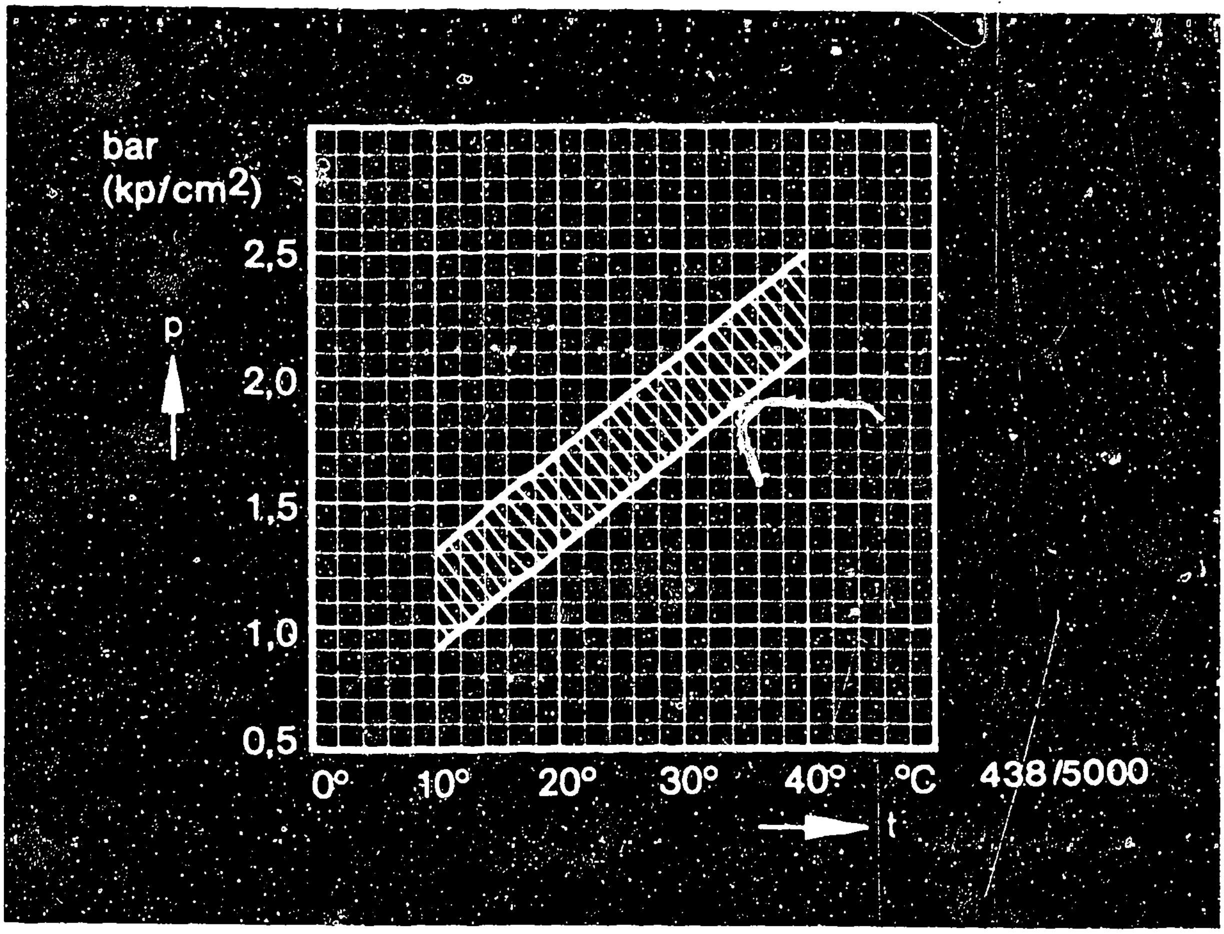
Open the valve screw of the directional control valve (both screws on KDEP 1034) by turning counter-clockwise.



a = to the warm-up regulator
b = to the pressure gauge
c = from the fuel distributor

14.6 Checking the "cold" control pressure

This check is made with the engine off.
The engine must be cold.
Best results are obtained if the engine has not run for several hours. Leave the engine off overnight if possible.
Unplug the electrical connector at the warm-up regulator.
Open the valve screw of the directional control valve (both screws on KDEP 1034).
Run the electric fuel pump by bridging the electrical safety circuit.



p = Control pressure (gauge pressure)
t = Ambient temperature

- Warm-up regulator order number: 0 438 140 094
  0 438 140 095

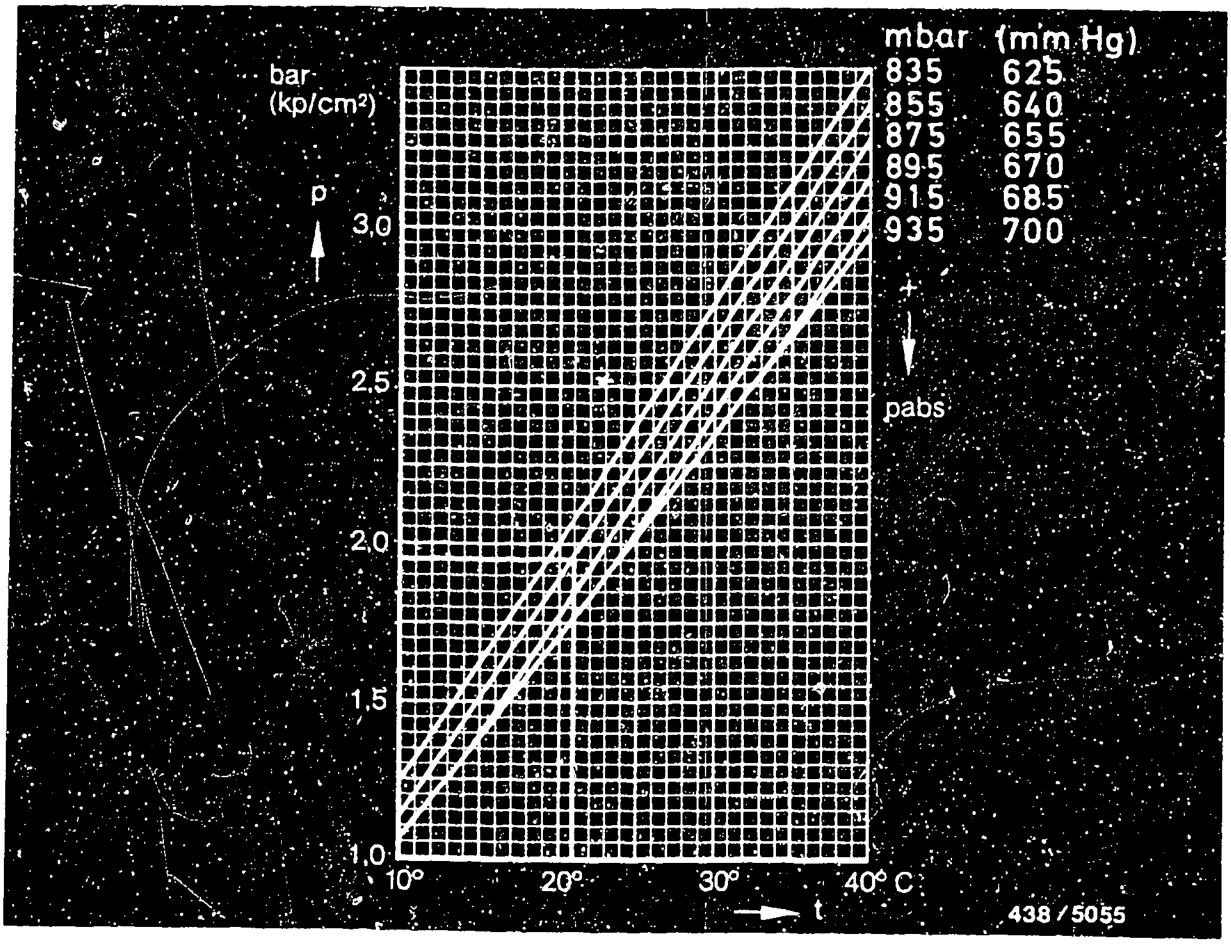
(Model for acceleration enrichment)

Perform the check with the engine off, i.e. without control pressure.

Determine the target control pressure in accordance with the ambient temperature from the above graph.

Example:

Ambient temperature	= 20°C
Target control pressure	= 1.3 ... 1.7 bar (gauge)



p = Control pressure (gauge pressure)
t = Ambient temperature
pabs = Air pressure

- Warm-up regulator: 0 438 140 130/ ... 131
  (model with altitude compensation)

Determine the target control pressure in accordance with the ambient temperature and atmospheric pressure from the above graph.
A tolerance of ±0.2 bar applies to the basic control pressure curve.
A tolerance of ±0.25 bar applies to the control pressure altitude curves.
The basic curve applies to atmospheric pressure greater than 935 mbar (700 mm Hg).

Example: Ambient temperature = 21°C
Atmospheric pressure = 855 mbar (640 mm Hg)
Target control pressure = 1.7 ... 2.2 bar gauge pressure

The following are possible causes for deviation of the measured "cold" control pressure from the target value:

- Fuel delivery rate too low or too high for control pressure circuit.
  Check fuel delivery rate.

  Test value: 160 ... 240 cm^3/min

- Fuel return line from warm-up regulator is blocked or restricted (if control pressure is too high).
  Remove restriction.

- Warm-up regulator is defective. Replace warm-up regulator.

If the warm-up regulator was replaced or a fault was found, the idle speed must then be set with the engine at operating temperature.

The idle adjustment procedure is explained at coordinates F 18.

NOTE:

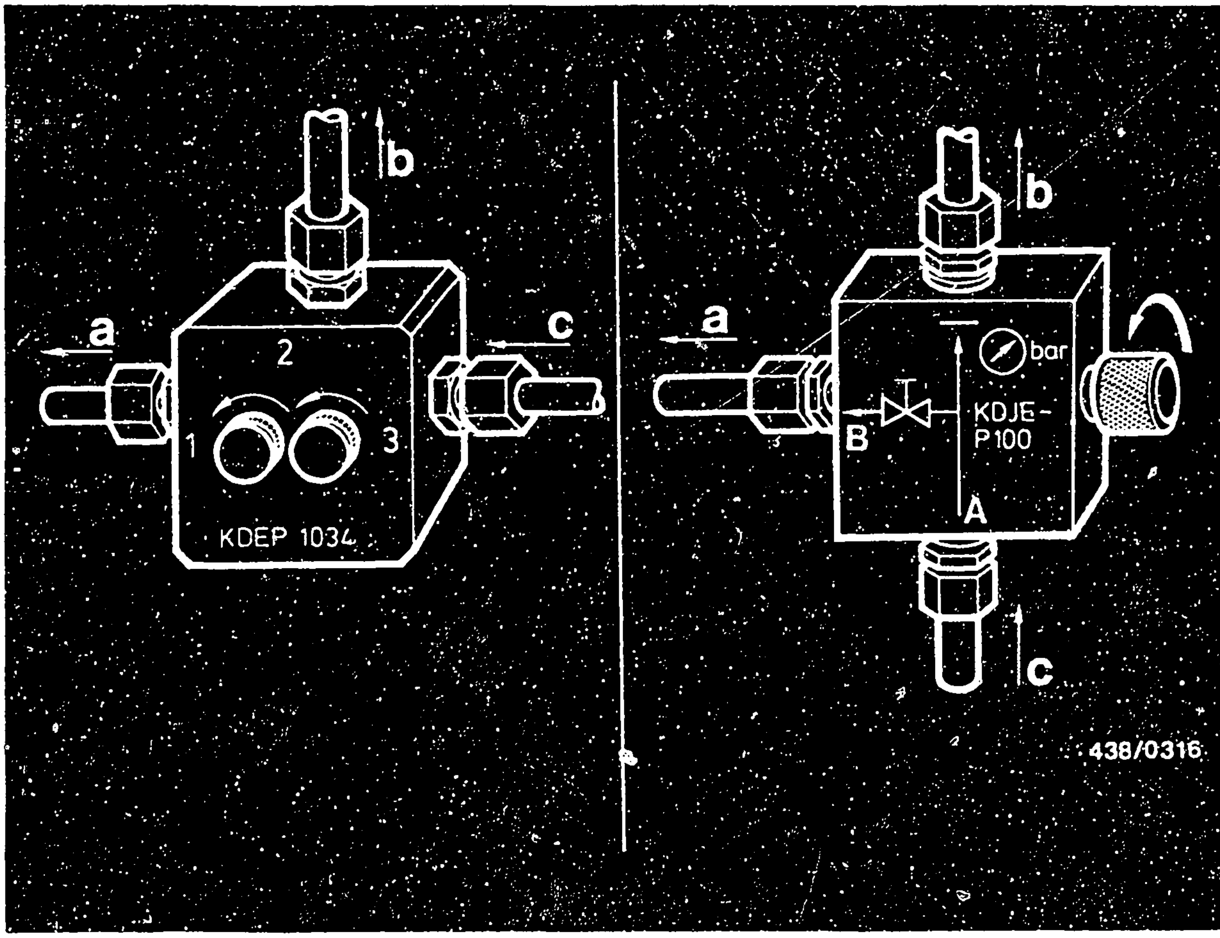
- Warm-up regulator: 0 438 140 094/ ... 095
  (model for acceleration enrichment)

The above control pressure check is used to determine if the control pressure circuit and warm-up regulator are in proper working order.

Faulty control pressure functions under driving conditions, however, may also be due to incorrect operation of the manifold pressure actuation system for the warm-up regulator.

This system must be checked with the engine running at operating temperature. This check should therefore be combined with subsequent idle adjustment.

The idle adjustment procedure is explained at coordinates F 18.



a = to the warm-up regulator
b = to the pressure gauge
c = from the fuel distributor

14.7 Checking the "warm" control pressure

- Warm-up regulator order number: 0 438 140 094/...095

  (model for acceleration enrichment)

This check is made with the engine off under atmospheric pressure and with a simulated manifold vacuum at the lower chamber.

Test procedure at atmospheric pressure

- Engine temperature is not important
- Open the valve screw of the directional control valve (both screws on KDEP 1034).
- Run the electric fuel pump by bridging the electrical safety circuit.
- Replace the connector at the warm-up regulator.

The control pressure will now increase (warm-up regulator settles) until the "warm" control pressure is reached.

The pressure gauge of the pressure tester indicates the "warm" control pressure.

Test value for "warm" control pressure (at atmospheric pressure), i.e. with engine off:

3.4 ... 3.8 bar (3.5 ... 3.9 kp/cm^2) gauge pressure

The following are possible causes for deviation of the measured "warm" control pressure from the target value:

If the control pressure is too high:

- Fuel delivery rate is too high for control pressure circuit.
  Check fuel delivery rate.
  Test value: 160...240 cm^3/min

- Fuel return line from warm-up regulator is blocked or restricted. Remove restriction.

- Warm-up regulator is hydraulically defective.
  Replace warm-up regulator.

If the control pressure is too low:

- Open circuit in electrical system.
  Repair open circuit. Make sure the connector makes good contact.

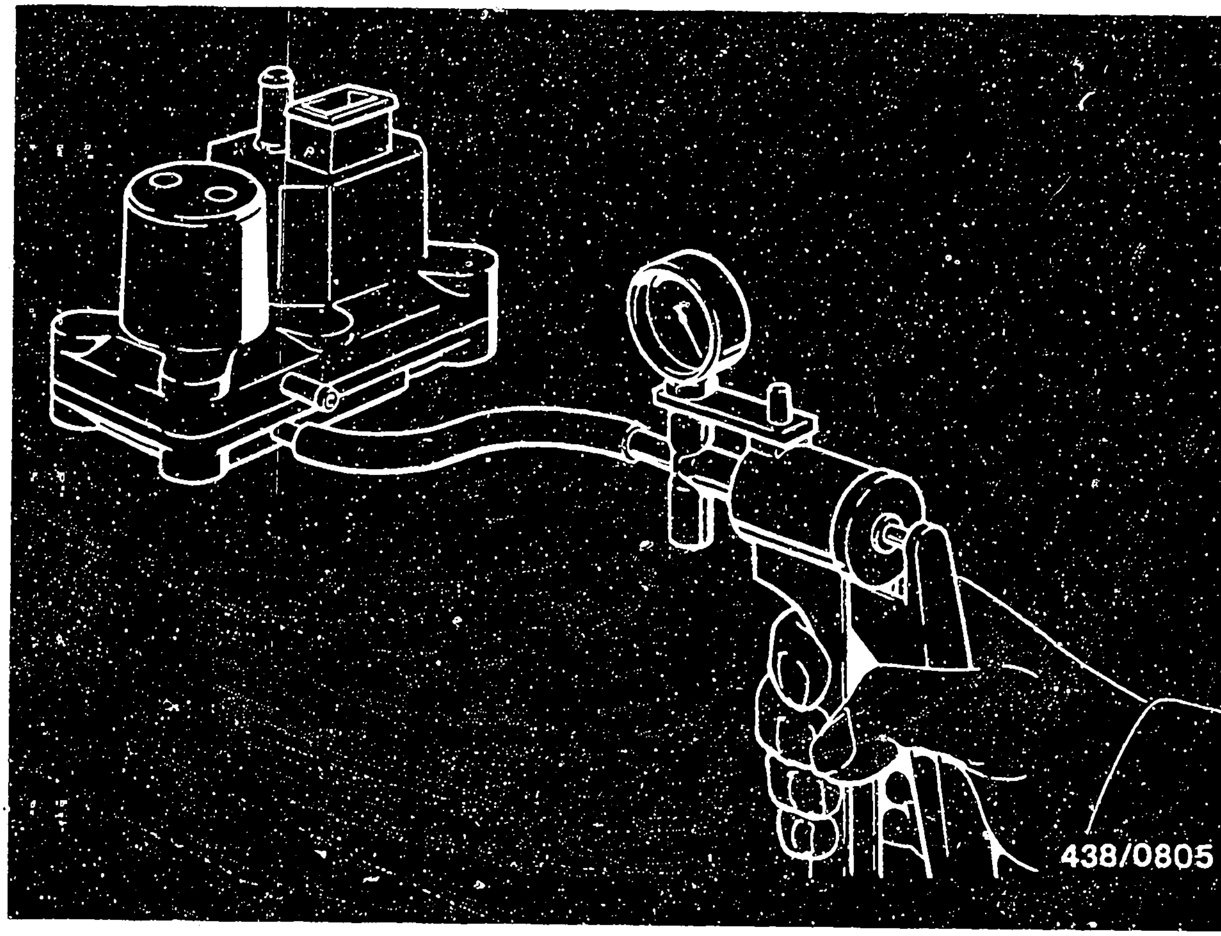
- Battery voltage too low -- voltage drop.
  Remedy voltage drop. Minimum voltage at connector: 11.5 V.
  Repeat the test procedure with the engine running if necessary, in order to achieve the normal generator voltage under driving conditions of approx. 14 V.

- Fuel delivery rate too low for control pressure circuit.
  Check fuel delivery rate.
  Test value: 160...240 cm^3/min

- Warm-up regulator defective. Open heating coil. Hydraulically defective. Replace warm-up regulator.

If the warm-up regulator was replaced or a fault was found, the idle speed must then be set with the engine at operating temperature.

The idle adjustment procedure is explained at coordinates F 18.



- Acceleration enrichment test procedure

The warm-up regulator must be subjected to a vacuum in order to check the acceleration enrichment control pressure.

Check the pressure with the electric fuel pump on and the warm-up regulator connector attached.

Connect the "Mityvac" hand vacuum pump to the manifold pressure connection of the lower chamber of the warm-up regulator, and pump down the chamber.
Setting value: 400...600 mbar
(300...450 mm Hg).

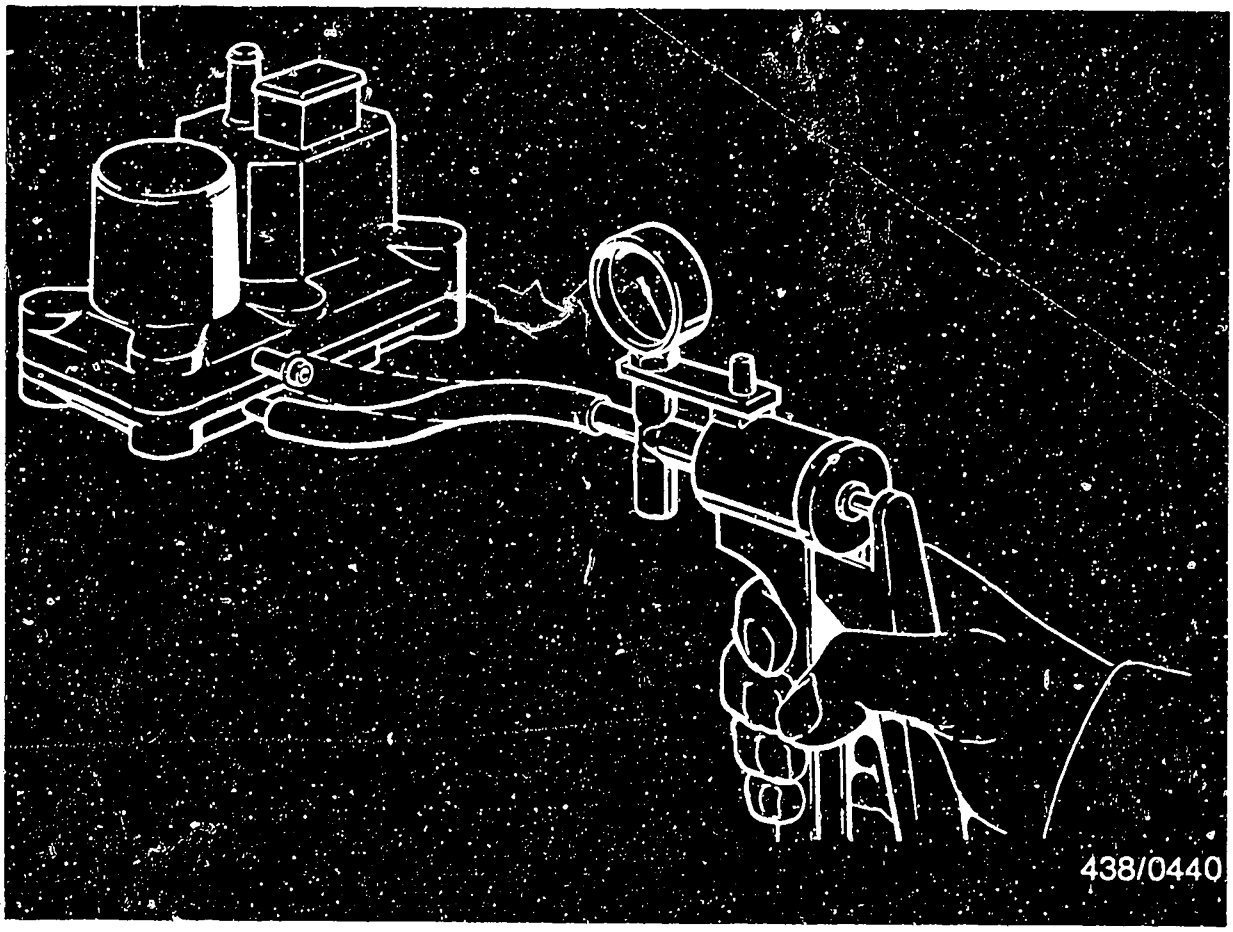
Test value for "warm" acceleration enrichment control pressure (with manifold pressure at the lower chamber):

1.4...1.8 bar (1.5...1.9 kp/cm²) gauge pressure

If the measured "warm" acceleration enrichment control pressure deviates from the test value, replace the warm-up regulator.

If the warm-up regulator was replaced or a fault was found, the idle speed must then be set with the engine at operating temperature.

The idle adjustment procedure is explained at coordinates F 18.



- Checking the leak-tightness of both acceleration enrichment chambers

Switch off the electric fuel pump.
Connect the "Mityvac" hand vacuum pump to the manifold pressure connection of the lower chamber, and pump down. Repeat procedure for the upper chamber.
Setting value: 400...600 mbar (300...450 mm Hg)

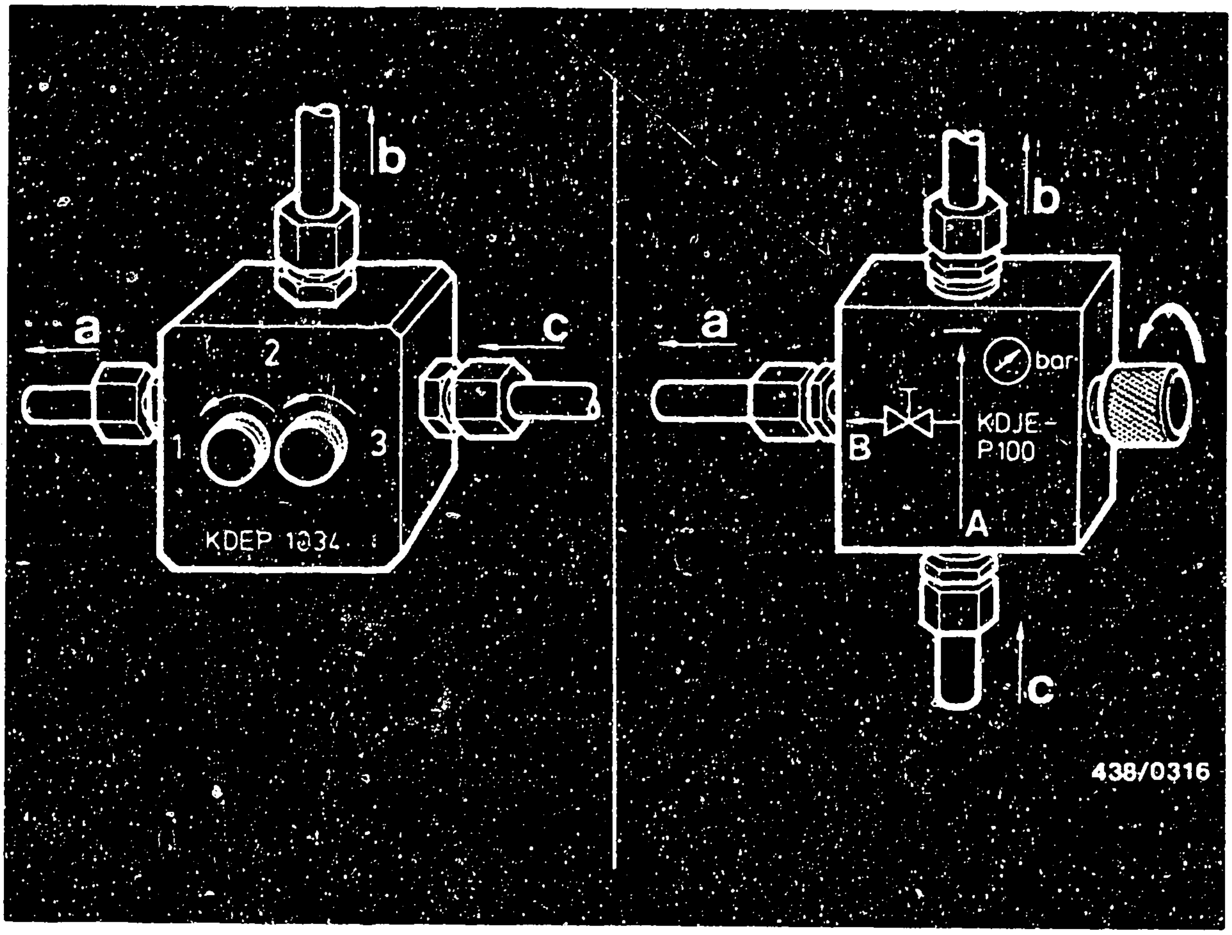
Test value for pneumatic leak-tightness of both chambers:
Max. pressure drop within 15 s: 100 mbar (75 mm Hg).
Replace warm-up regulator if pressure drop is too great.

N O T E :

Faulty control pressure functions under driving conditions, however, may also be due to incorrect operation of the manifold pressure actuation system for the warm-up regulator.
For this reason, check to make sure that the hose is connected correctly from the intake manifold to the warm-up regulator, and make sure the hose is in good condition. Check the system with the engine running and at operating temperature. This procedure should be combined with subsequent idle adjustment.

If the warm-up regulator was replaced or a fault was found, the idle speed must then be set with the engine at operating temperature.

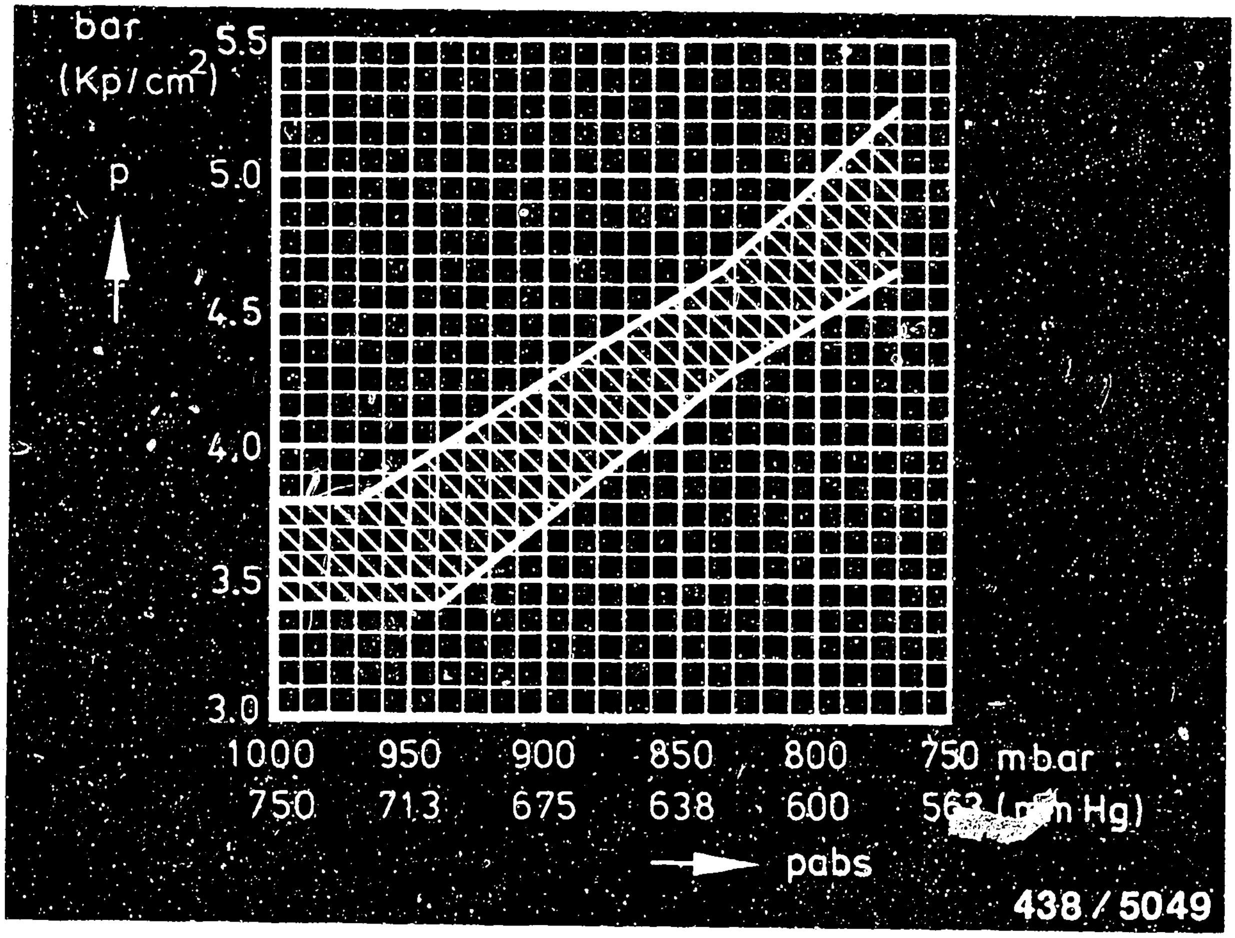
The idle adjustment procedure is explained at coordinates F 18.



a = to the warm-up regulator
b = to the pressure gauge
c = from the fuel distributor

- Warm-up regulator order number: 0 438 140 130/...131 (model with altitude compensation)

- This check is performed at atmospheric pressure with the engine off.
- Engine speed is not important.
- Open the valve screw of the directional control valve (both screws on KDEP 1034).
- Run the electric fuel pump by bridging the electrical safety circuit.
- Restore connector at warm-up regulator. The control pressure will now increase (warm-up regulator settles) until the "warm" control pressure is reached. The pressure gauge of the pressure tester indicates the "warm" control pressure.



p = Control·pressure (gauge pressure)
pabs = Air pressure

Measure the control pressure immediately after the warm-up regulator has settled.

Determine the target control pressure in accordance with the atmospheric pressure from the above graph.

Example: Atmospheric pressure = 850 mbar (638 mm Hg)
Target control pressure = 4.13 ... 4.55 bar gauge pressure

The following are possible causes for deviation of the measured "warm" control pressure from the target value:

If the control pressure is too high:

- Fuel delivery rate is too high for control pressure circuit.
  Check fuel delivery rate.
  Test value: 160...240 cm^3/min

- Fuel return line from warm-up regulator is blocked or restricted. Remove restriction.

- Warm-up regulator is hydraulically defective. Replace warm-up regulator.

If the control pressure is too low:

- Open circuit in electrical system.
  Repair open circuit. Make sure the connector makes good contact.

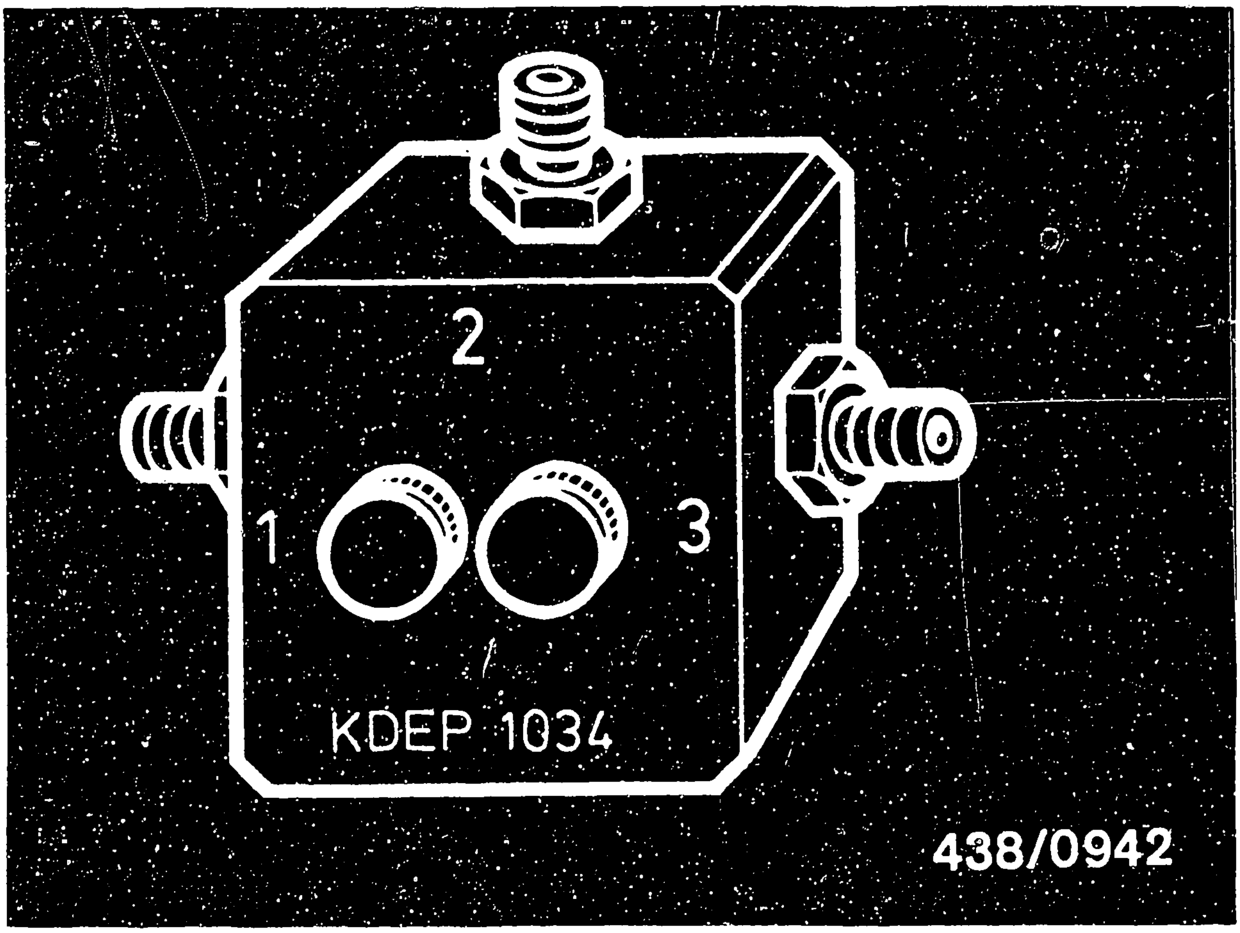
- Battery voltage too low -- voltage drop.
  Remedy voltage drop. Minimum voltage at connector: 11.5 V.
  Repeat the test procedure with the engine running if necessary, in order to achieve the normal generator voltage under driving conditions of approx. 14 V.

- Fuel delivery rate is too low for control pressure circuit.
  Check fuel delivery rate.
  Test value: 160 ... 240 cm^3/min

- Warm-up regulator is defective. Open heating coil. Hydraulically defective. Replace warm-up regulator.

If the warm-up regulator was replaced or a fault was found, the idle speed must then be set with the engine at operating temperature.

The idle adjustment procedure is explained at coordinates F 18.

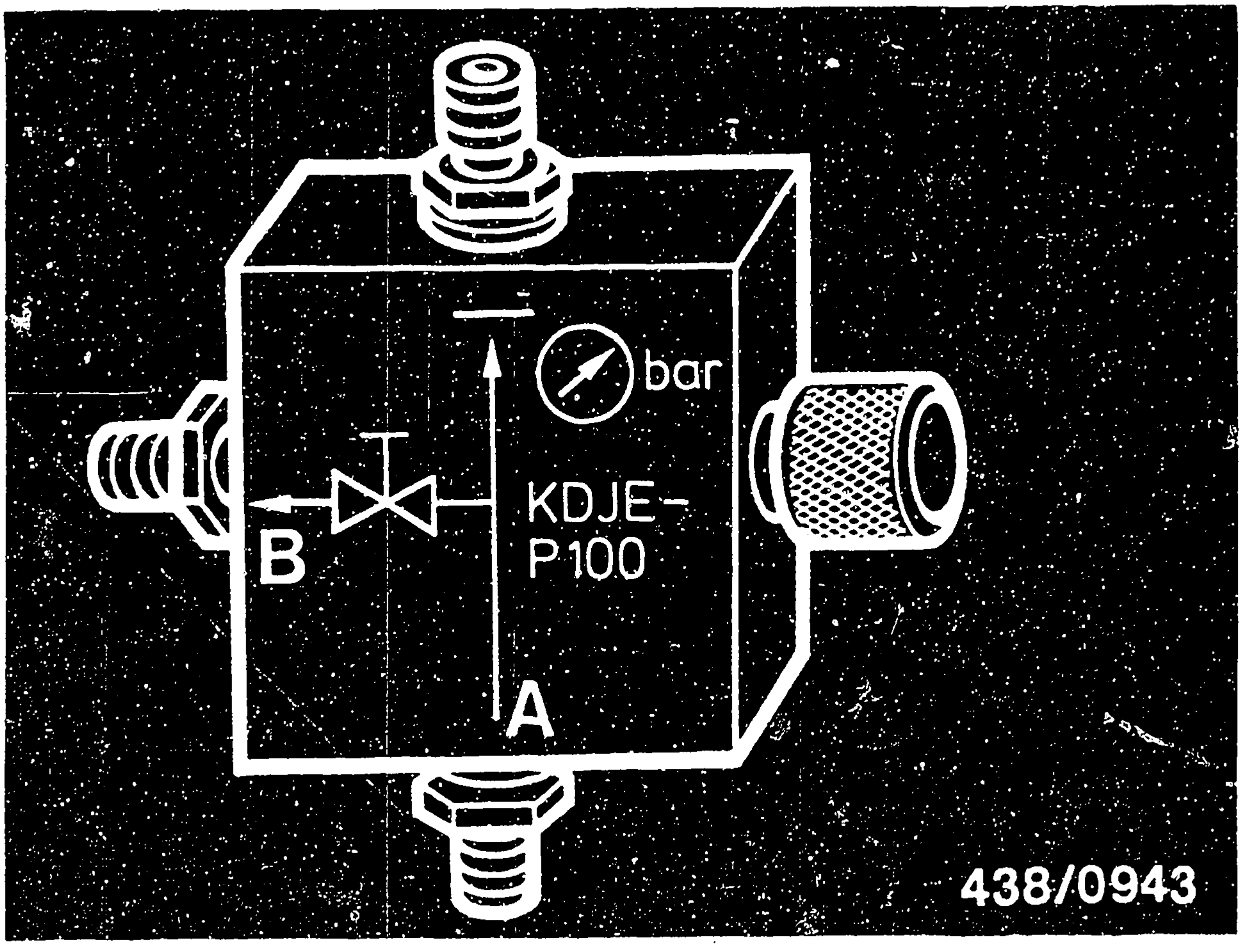


15. Checking and setting the primary pressure

15.1 Attaching pressure tester KDJE-P 100 (formerly KDEP 1034):

Pressure tester KDEP 1034 comprises a three-way valve with two separate valve screws.

The ports of the directional control valve are numbered.



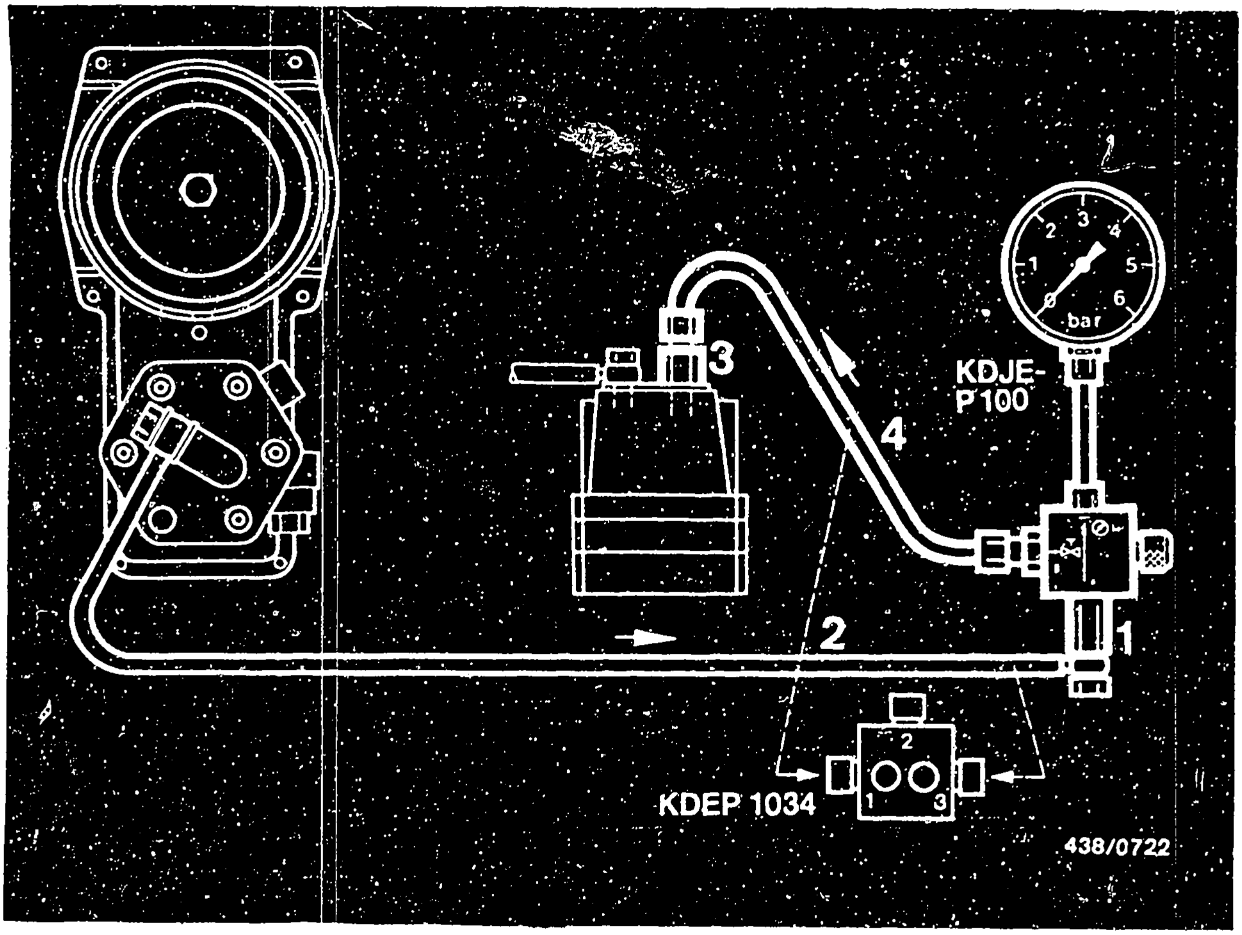
Since the end of 1979, pressure tester KDJE-P 100 has a directional control valve with only one valve screw. The ports of this directional control valve are graphically indicated on the side of the unit:

A = Inlet (from fuel distributor)

B = Outlet (to warm-up regulator)

Caution!

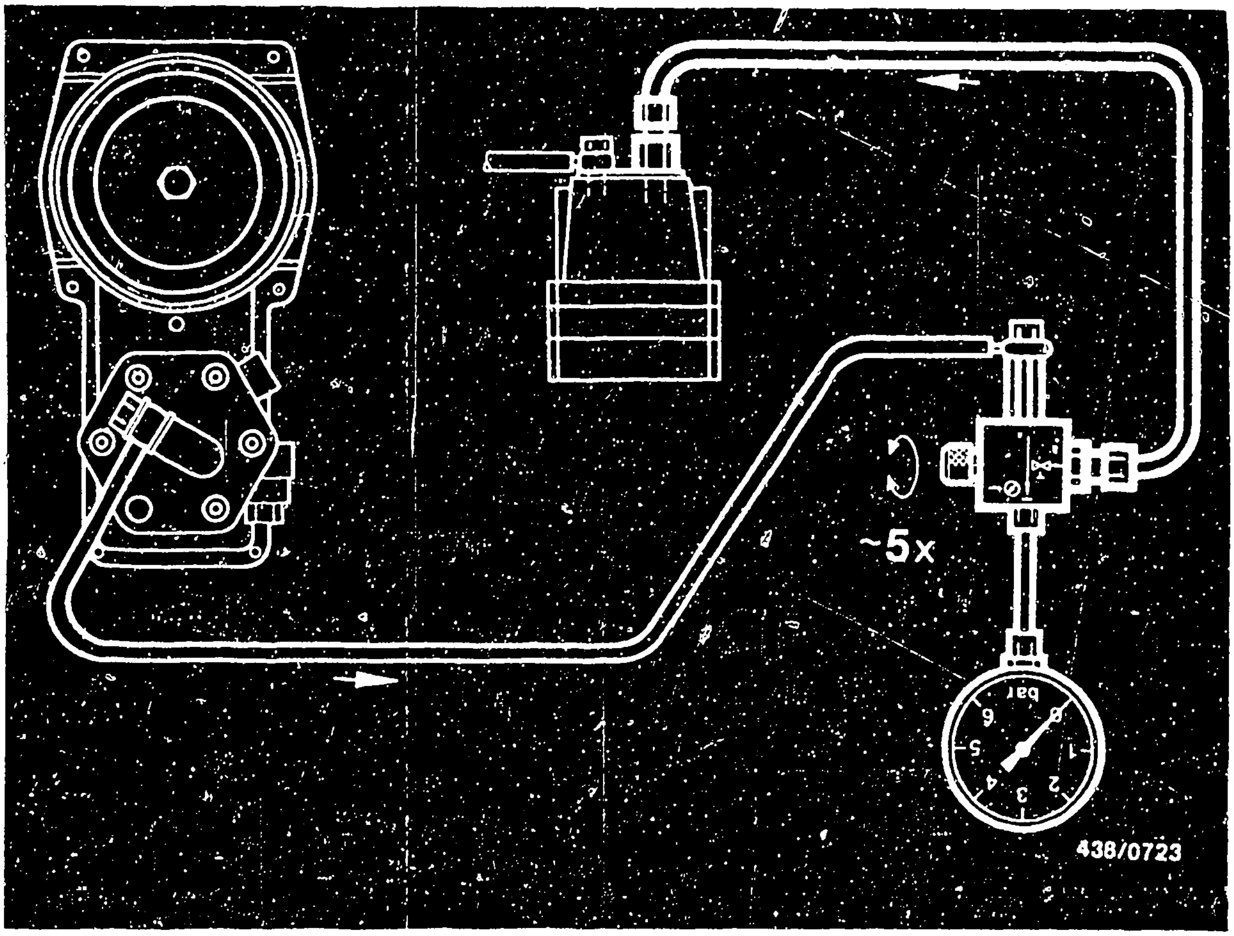
When the directional control valve is not in use, always leave the valve screw(s) open to relieve the seals.



The directional control valve of the pressure tester is placed in the control pressure line between the fuel distributor and the warm-up regulator.
Use connecting parts set KDJE-P 100 / 12.

- Screw adapter (1) with seal into inlet nozzle A or 3 of the directional control valve.
- Unscrew control pressure line (2) from the warm-up regulator and connect this line to adapter (1) using a hollow bolt of size M 10 x 1 and seals.
- Screw connector (3) of the connecting parts set into the inlet of the warm-up regulator, and connect to outlet nozzle B or 1 of the directional control valve using hose (4).

Hang the pressure gauge on the hood of the car using a wire hook if necessary.



15.2 Bleeding the pressure tester:

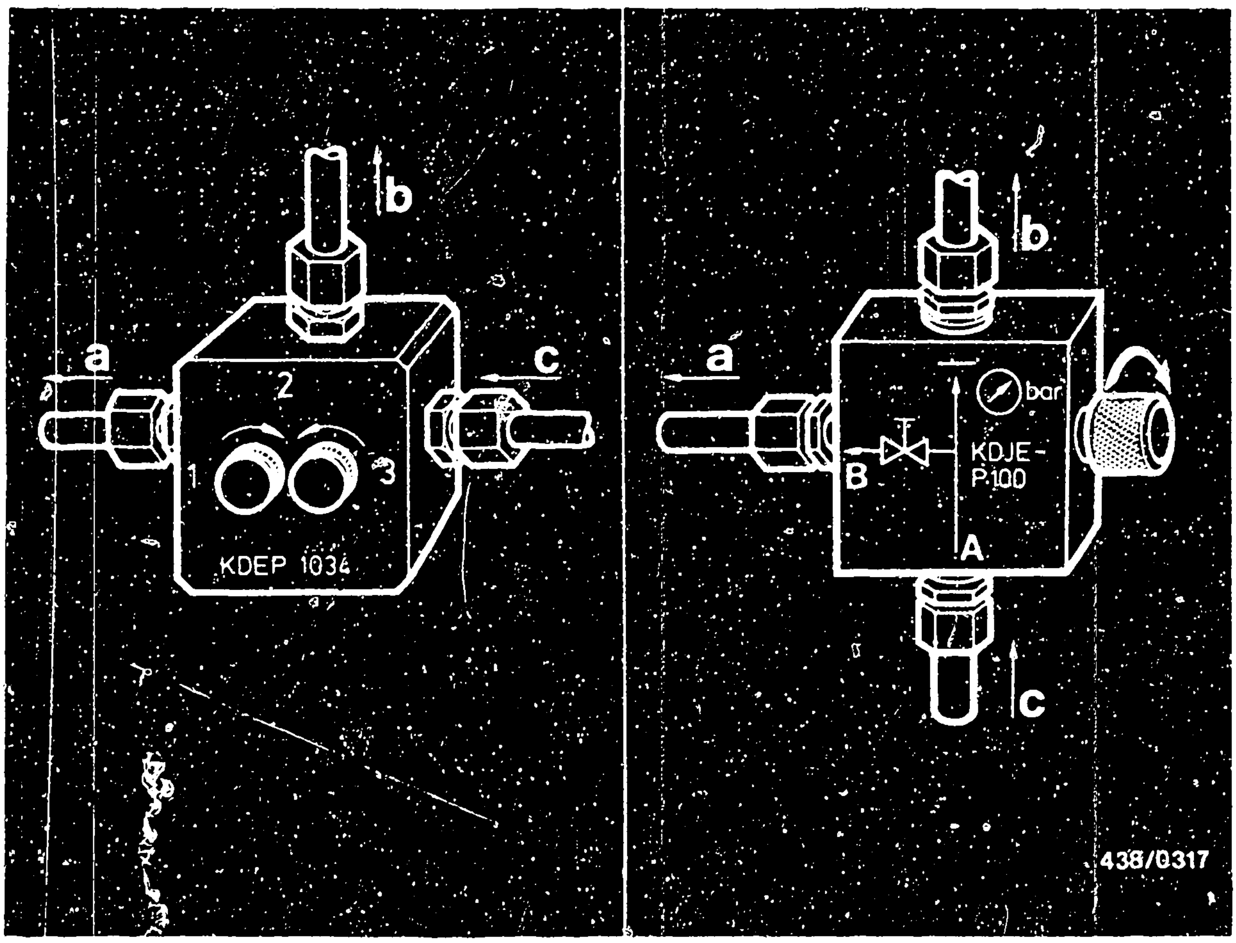
Unplug the electrical connector from the warm-up regulator. Allow the pressure gauge to hang downward so that the connecting tubing is straight.

Run the electric fuel pump by bridging the electrical safety circuit.

Open and close the valve screw(s) of the directional control valve approximately 5 times at 10-second intervals.

Then hang the pressure gauge in a suitable place (e.g. on one of the hood braces).

Open the valve screw of the directional control valve (both screws on KDEP 1034) by turning counter-clockwise.



a = to the warm-up regulator
b = to the pressure gauge
c = from the fuel distributor

15.3 Checking the primary pressure

This check is performed with the engine off.
Engine temperature is not important.

Close the valve screw of directional control valve KDJE-P 100. If using KDEP 1034, close valve screw 1 and open valve screw 3.

Run the electric fuel pump by bridging the electrical safety circuit.

The pressure gauge now indicates primary pressure.

Fuel distributor order number	Test values for primary pressure (gauge pressure)
0 438 100 127	4.7...5.4 bar (4.8...5.5 kp/cm²)

The following are possible causes for primary pressure which is too l o w:

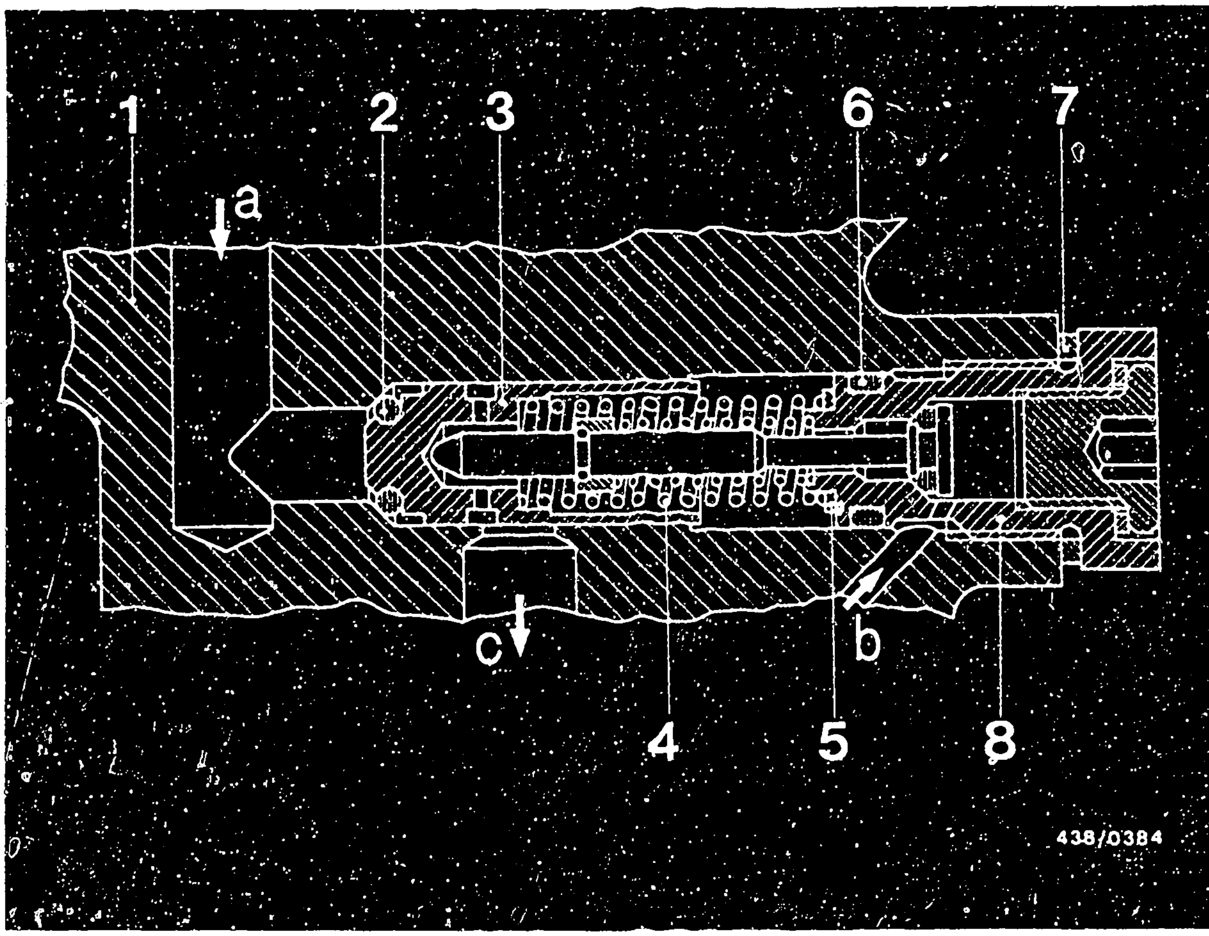
- Fuel supply system not operating properly. (Electric fuel pump delivery rate too low).
- Primary pressure set incorrectly.

  Resetting the primary pressure assumes that the fuel supply system is operating properly, i.e. that the delivery rate is at least 850 cm^3/30 s.

The following are possible causes for primary pressure which is too h i g h:

- Return line to fuel tank is restricted.

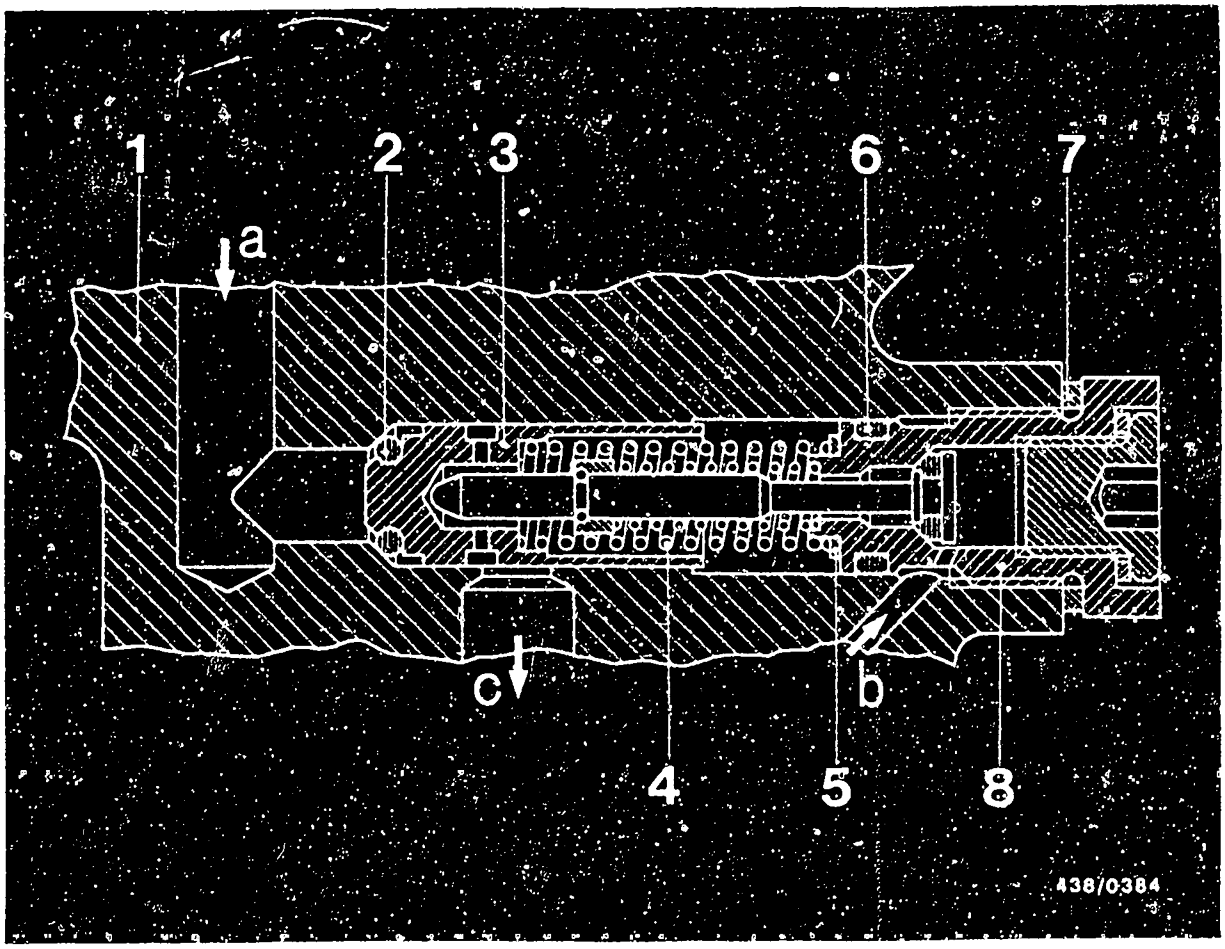
  Primary pressure set incorrectly.
- Before resetting primary pressure which is too high, always first check the return line to the fuel tank.



a = Primary pressure
b = From the warm-up regulator
c = Fuel return outlet
1 = Fuel distributor housing
2 = O-ring
3 = Control plunger
4 = Control spring
5 = Shim(s)
6 = O-ring
7 = Flat seal
8 = Screw plug

15.4 Setting the primary pressure

Fuel distributor order number	Setting values for primary pressure (gauge pressure)
0 438 100 127	4.9...5.1 bar (5.0...5.2 kp/cm²)



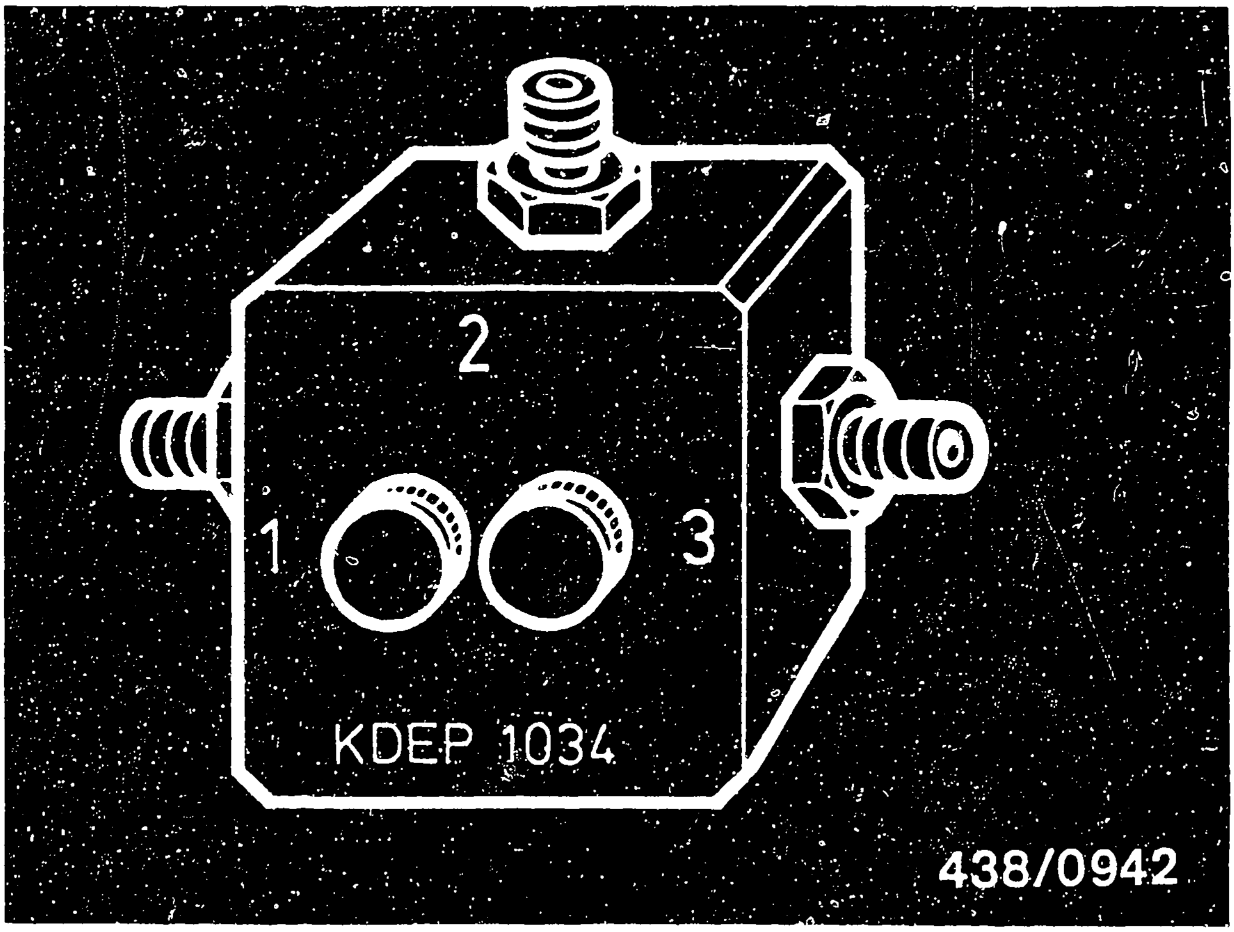
The primary pressure is reset by replacing the shims (5).

N o t e :

An increase of 0.1 mm in shim thickness increases the pressure by approx. 0.15 bar, and vice versa.

To reset the primary pressure, unscrew plug (8) including push valve. After the pressure has been reset, replace the screw plug using a new flat seal (7) and O-ring (6).

Do not lose the control plunger (3) of the primary pressure regulator. It has been matched at the factory to the fuel distributor housing, and is the only part of the primary pressure regulator which c a n n o t be replaced.

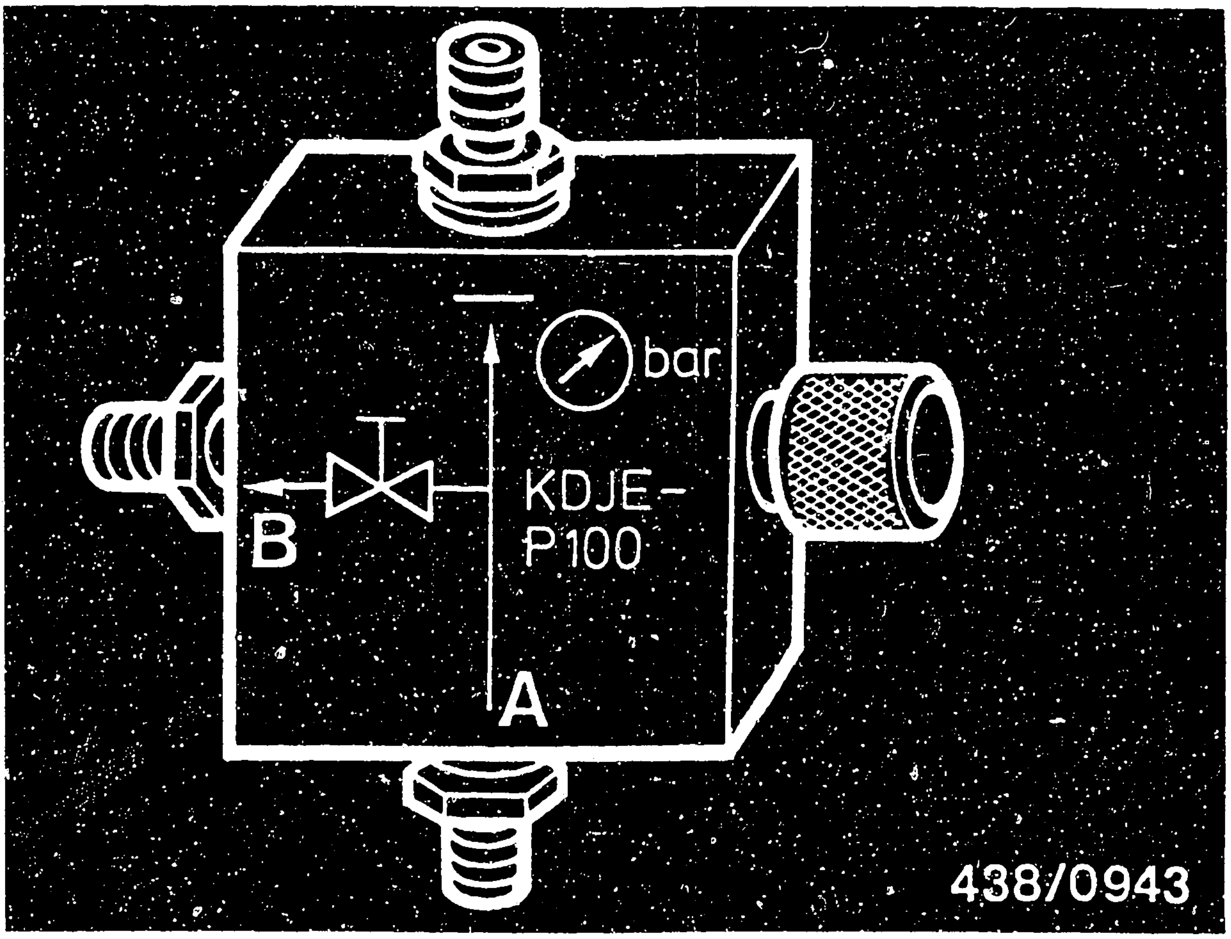


16. Checking entire fuel system for internal leak-tightness

16.1 Attaching pressure tester KDJE-P 100 (formerly KDEP 1034):

Pressure tester KDEP 1034 comprises a three-way valve with two separate valve screws.

The ports of the directional control valve are numbered.



Since the end of 1979, pressure tester KDJE-P 100 has a directional control valve with only one valve screw.

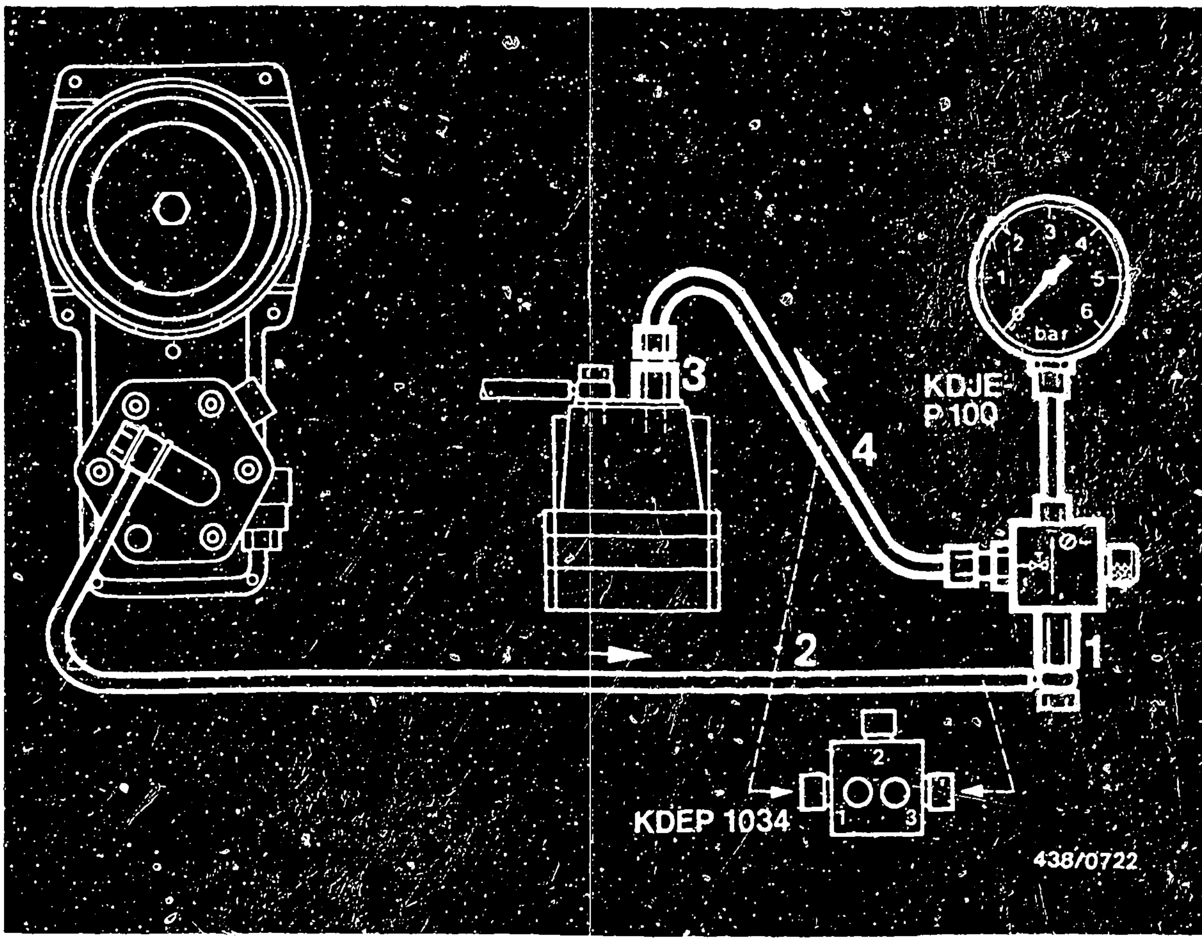
The ports of this directional control valve are graphically indicated on the side of the unit:

A = Inlet (from fuel distributor)

B = Outlet (to warm-up regulator)

Caution!

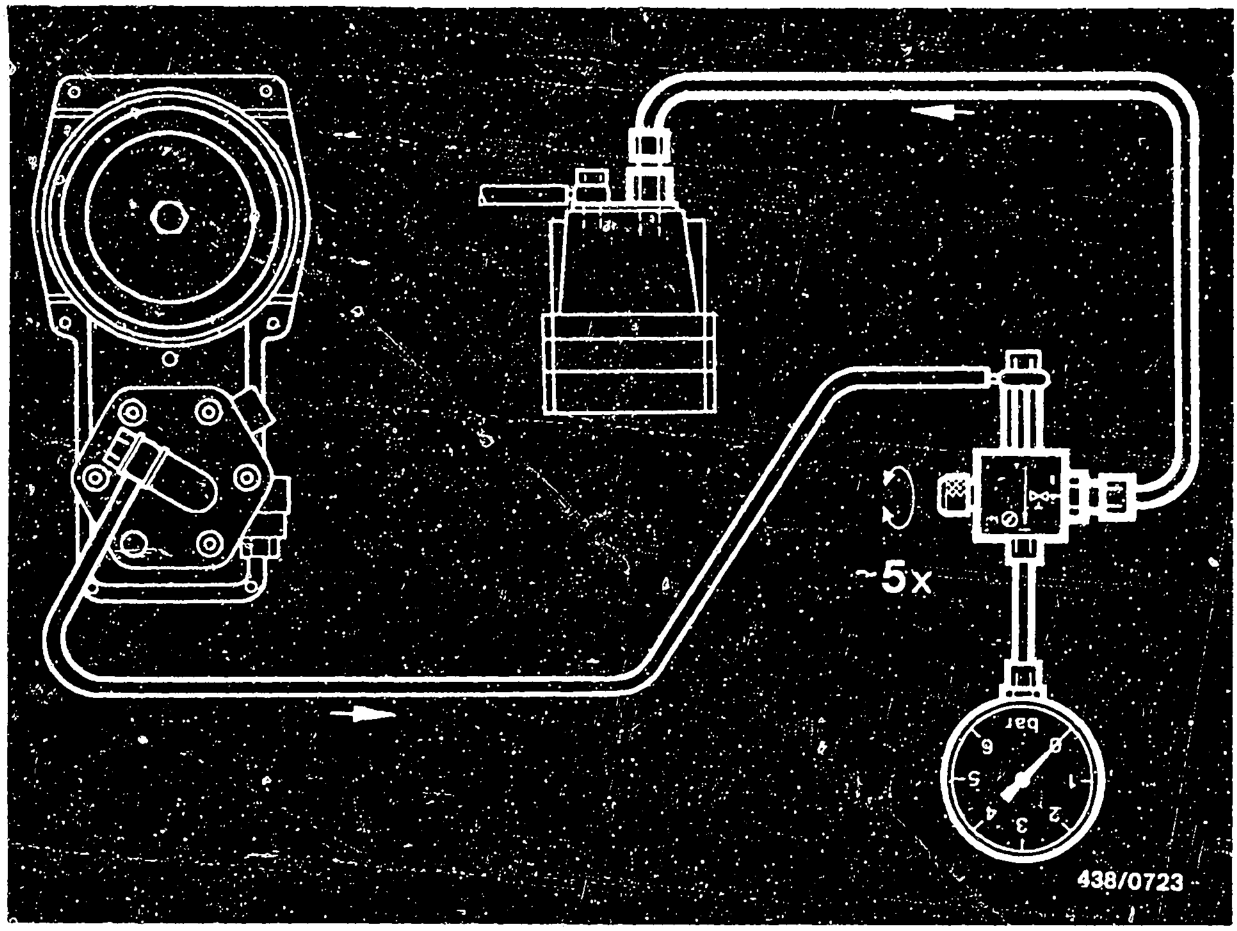
When the directional control valve is not in use, always leave the valve screw(s) open to relieve the seals.



The directional control valve of the pressure tester is placed in the control pressure line between the fuel distributor and the warm-up regulator.
Use connecting parts set KDJE-P 100 / 12.

- Screw adapter (1) with seal into inlet nozzle A or 3 of the directional control valve.
- Unscrew control pressure line (2) from the warm-up regulator and connect this line to adapter (1) using a hollow bolt of size M 10 x 1 and seals.
- Screw connector (3) of the connecting parts set into the inlet of the warm-up regulator, and connect to outlet nozzle B or 1 of the directional control valve using hose (4).

Hang the pressure gauge on the hood of the car using a wire hook if necessary.



16.2 Bleeding the pressure tester:

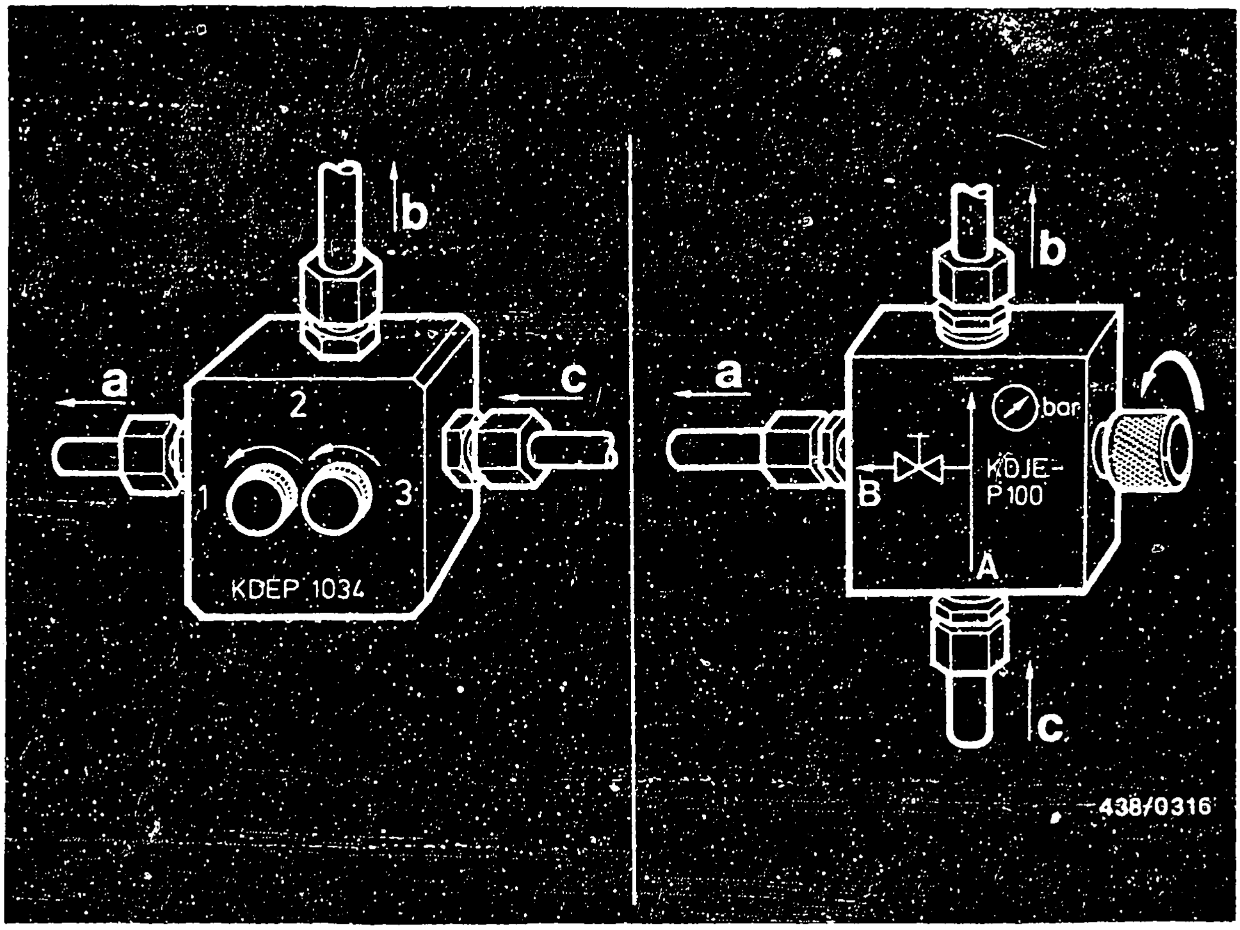
Unplug the electrical connector from the warm-up regulator. Allow the pressure gauge to hang downward so that the connecting tubing is straight.

Run the electric fuel pump by bridging the electrical safety circuit.

Open and close the valve screw(s) of the directional control valve approximately 5 times at 10-second intervals.

Then hang the pressure gauge in a suitable place (e.g. on one of the hood braces).

Open the valve screw of the directional control valve (both screws on KDEP 1034) by turning counterclockwise.



a = to the warm-up regulator
b = to the pressure gauge
c = from the fuel distributor

16.3 Leak test

This check is performed with the engine off.

The engine should be at operating temperature, however not extremely hot.

Open the valve screw of the directional control valve (both screws on KDEP 1034).

Bridge the electrical safety circuit and run the electric fuel pump until the warm-up regulator has settled ("warm" control pressure).

Turn off electric fuel pump and observe the pressure drop indicated by the pressure gauge.

Test values for leak-tightness:

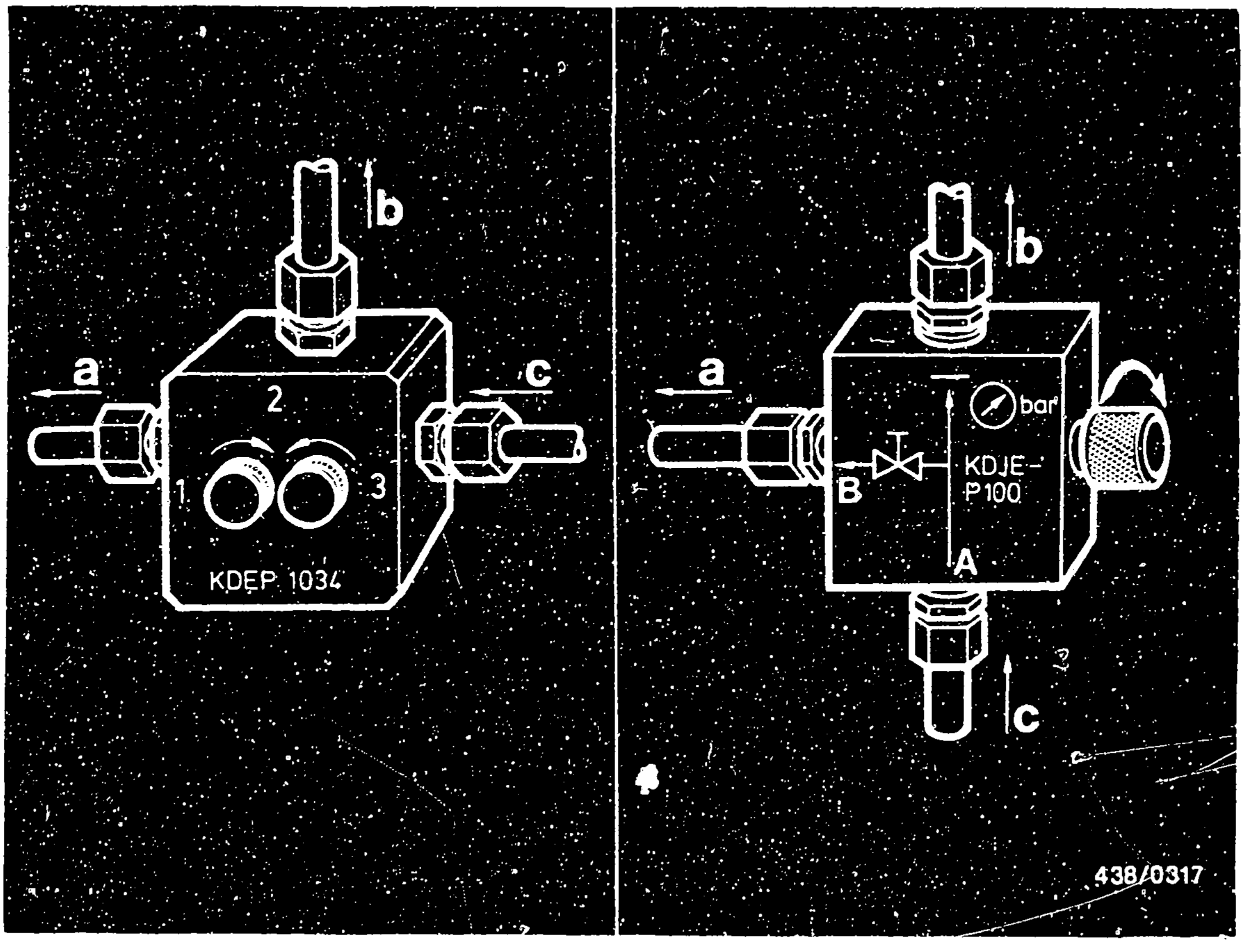
For fuel accumulator
order numbers:

0 438 170 040
0 438 170 041

Minimum pressure:

after 10 minutes: 2.5 bar (2.6 kp/cm²) gauge pressure

after 20 minutes: 2.4 bar (2.5 kp/cm²) gauge pressure



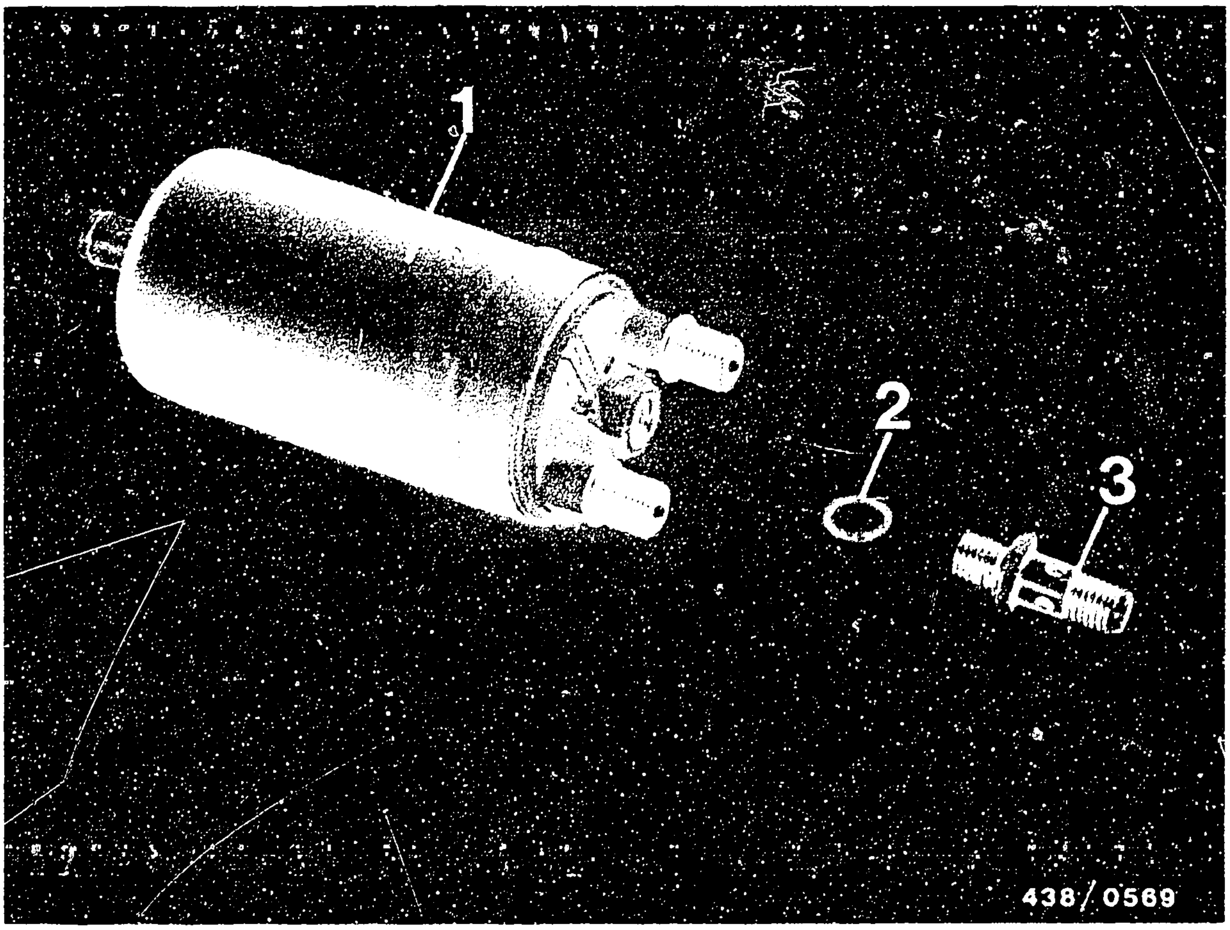
a = to the warm-up regulator
b = to the pressure gauge
c = from the fuel distributor

If the pressure drops too rapidly, repeat the leak test with the control pressure circuit disconnected.

Valve screw positions:

Close the valve screw of the KDJE-P 100 directional control valve. If using KDEP 1034, close valve screw 1 and open valve screw 2.

If the test results are the same, the problem is in the primary pressure circuit.
If the results of the second test are O.K., the leak is in the control pressure circuit.



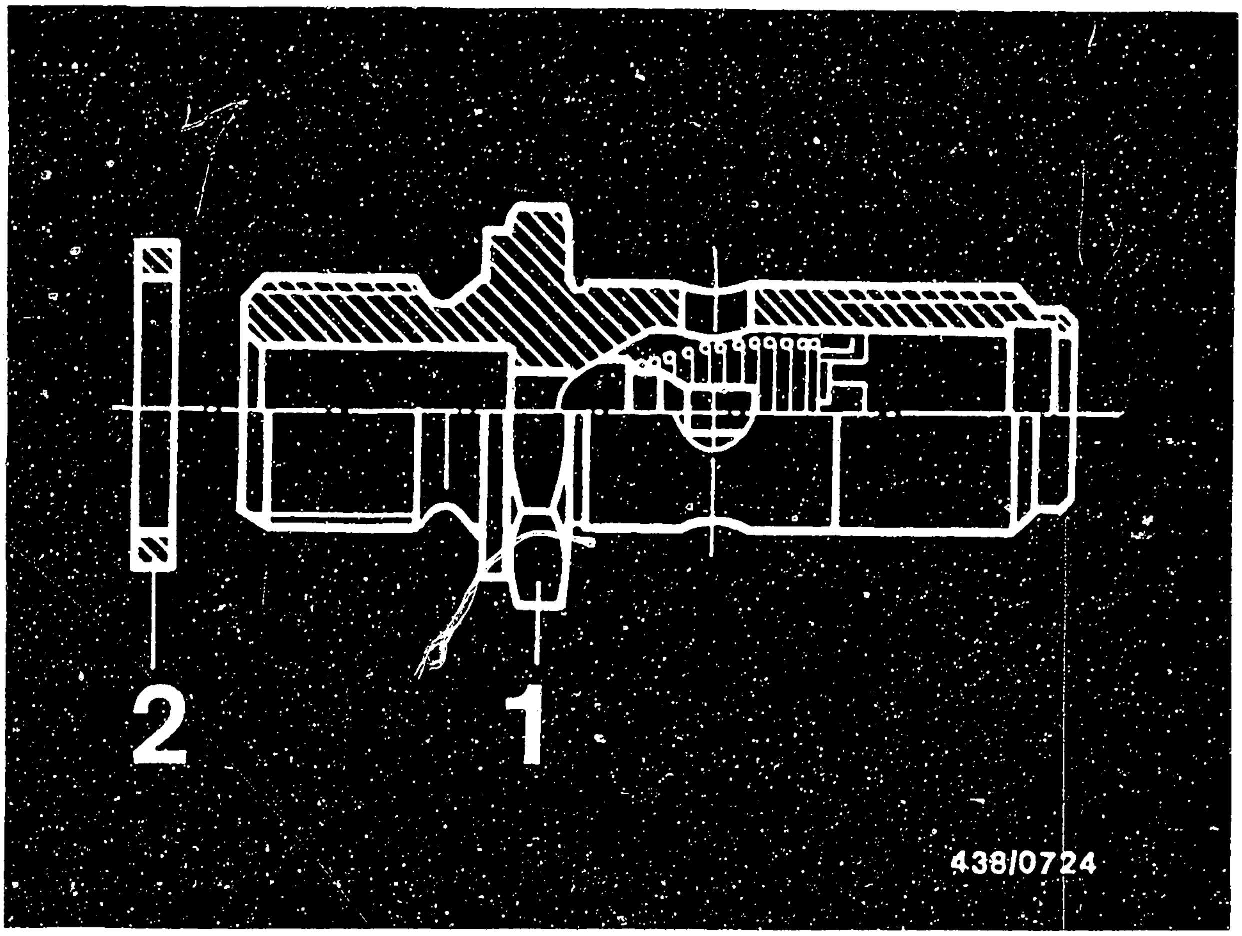
1 = Electric fuel pump
2 = Flat seal
3 = Threaded nozzle

16.4 Possible primary pressure circuit faults

- Leaking check valve in the threaded nozzle of the electric fuel pump.

Vehicles with a separate electric fuel pump.
Electric fuel pump order number: 0 580 254 959/960

The check valve is an integral part of the threaded nozzle.



1 = Threaded nozzle with integral check valve
2 = Flat seal

Parts set: 1 587 010 002

If necessary, replace the threaded nozzle using parts set 1 587 010 002 as follows:

Thoroughly clean the electric fuel pump delivery connection.

Clamp off the suction hose from the fuel tank to the electric fuel pump (e.g. using shutoff clamp W 157 made by the Matra Company).

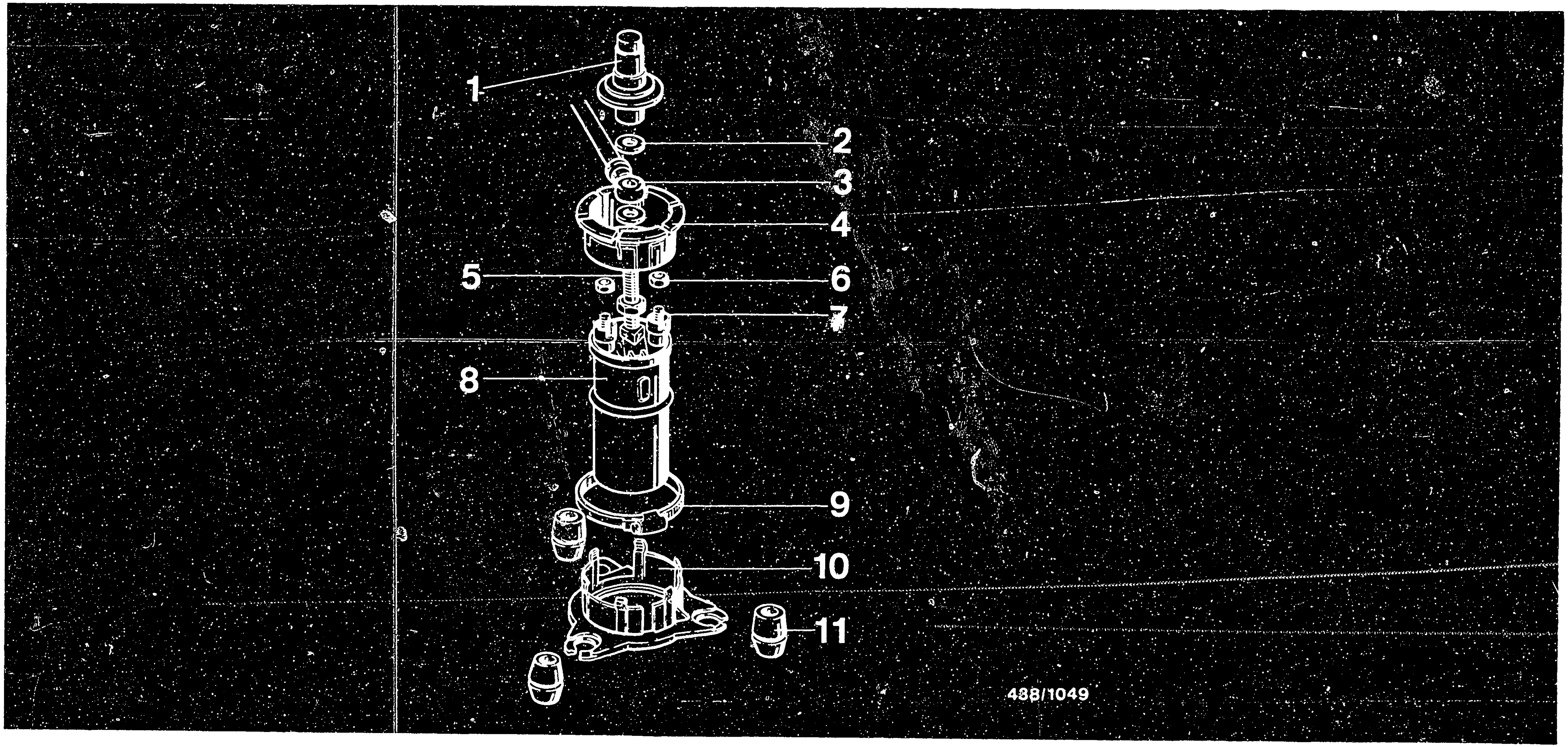
Unscrew the delivery line and catch gasoline in a suitable container.

Unscrew defective threaded nozzle.

Screw a new threaded nozzle (short end) into the delivery nozzle using a thick flat seal and tighten to a torque of 17 ... 25 Nm.
Back up the delivery nozzle by holding a wrench on its hexagonal surface.

Slide a thin flat seal, banjo union and the other flat seal onto the long end of the threaded nozzle and tighten the hexagonal cap nut.
Remove the shutoff clamp from the suction hose.

Allow the electric fuel pump to run and check all connections for leak-tightness.

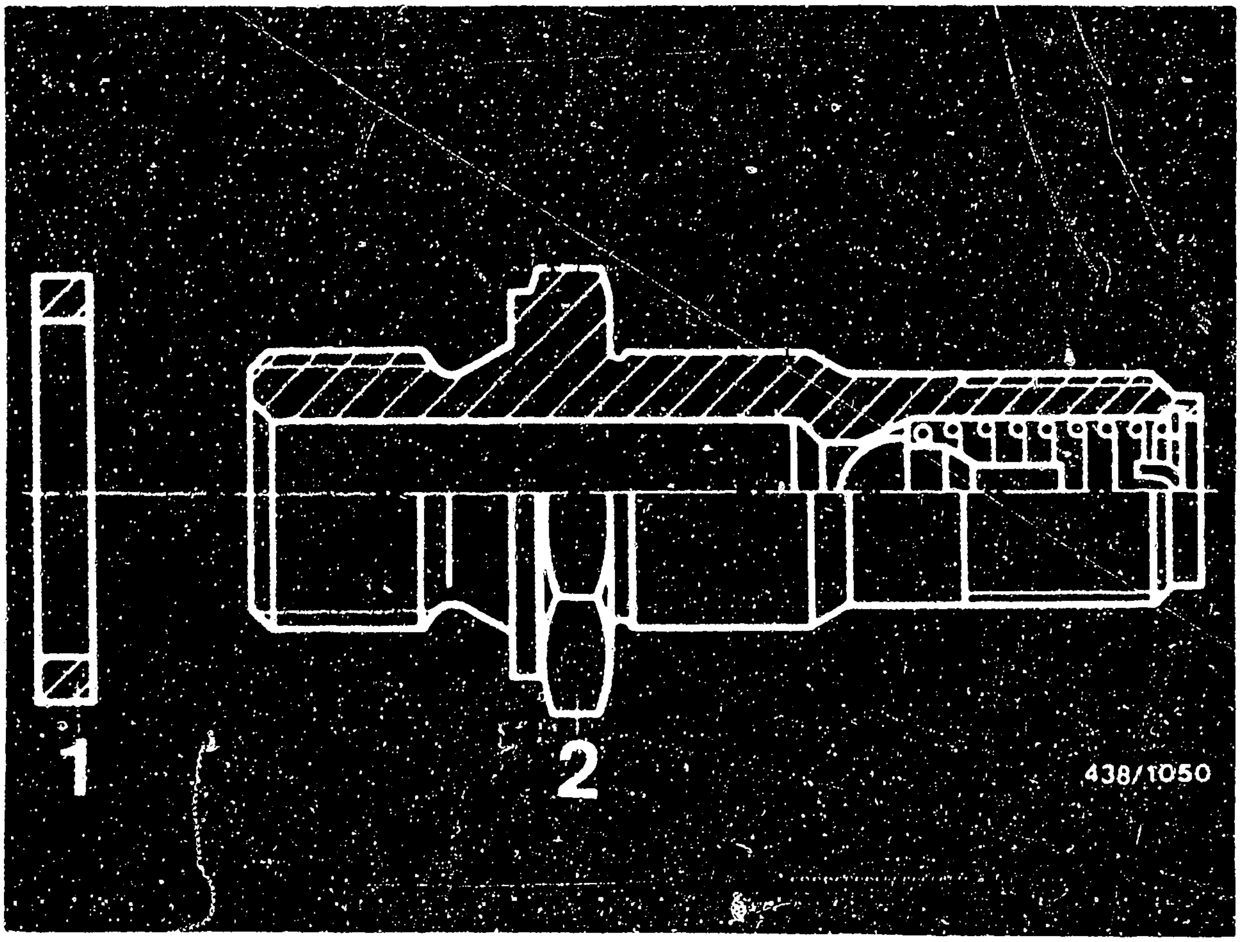


1 = Pressure damper	5 = Check valve	9 = Hose clamp
2 = Seal	6 = Hexagon nut	10 = Mounting bracket
3 = Feed line	7 = Electrical connections	11 = Rubber mount
4 = Clamping sleeve	8 = Electric fuel pump	

- Leaking check valve in the threaded nozzle of the in-tank electric fuel pump

Electric fuel pump order number: 0 580 254 001/ ... 002/ ... 003/ ... 004

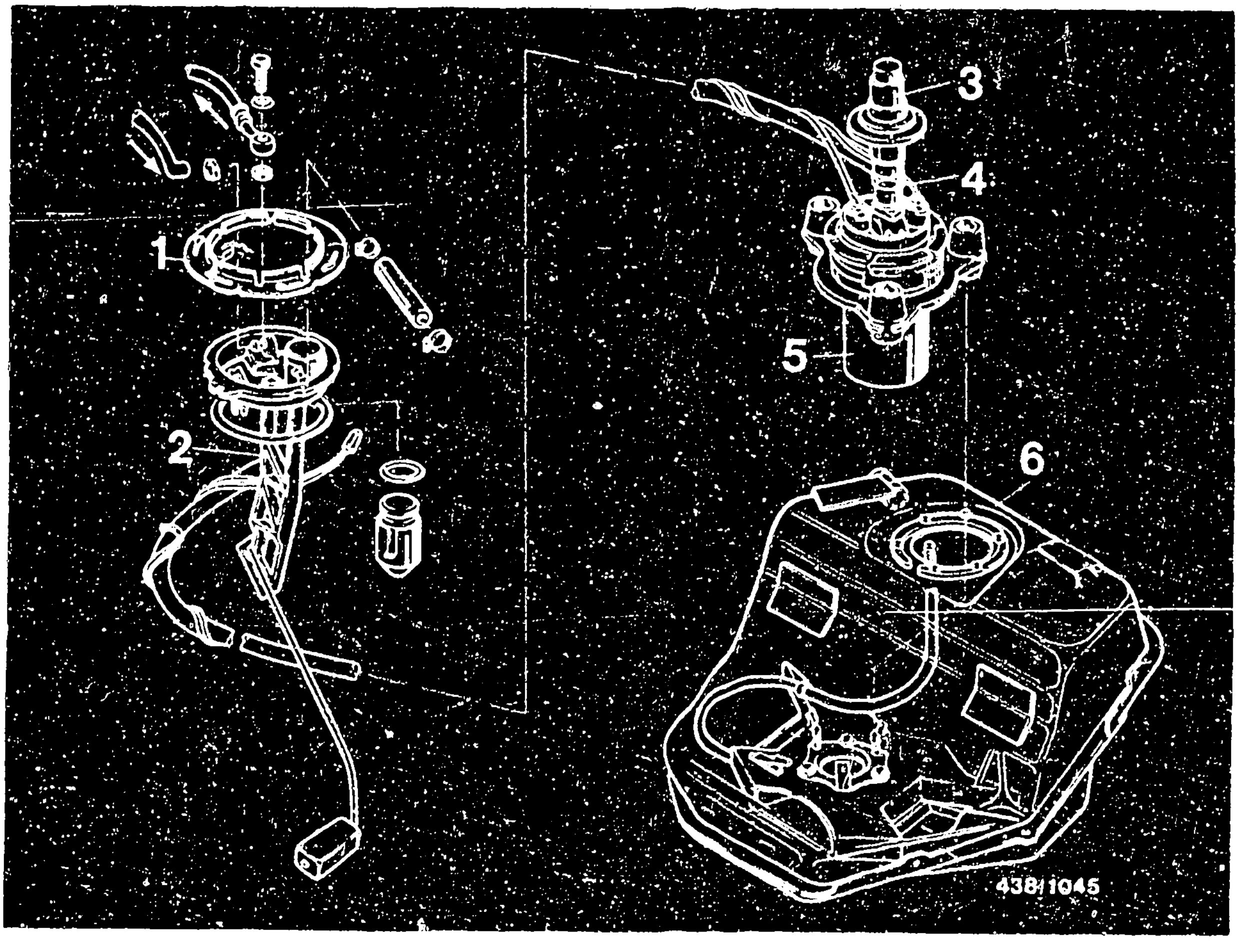
The check valve is an integral part of the threaded nozzle.



1 = Flat seal
2 = Threaded nozzle with integral
check valve

Parts set: 1 587 010 500

If necessary, replace the threaded nozzle using parts set 1 587 010 500 as follows:



1 = Closure ring
2 = Pickup for fuel indicator
3 = Pressure damper
4 = Check valve
5 = Electric fuel pump
6 = Fuel tank

Remove the closure ring and withdraw the pickup for the fuel indicator.

Remove the complete unit (electric fuel pump, check valve and pressure damper) from the clips holding it to the bottom of the tank.

Unscrew the pressure damper and remove the feed line with flat seals.

Unscrew the threaded nozzle with defective check valve.

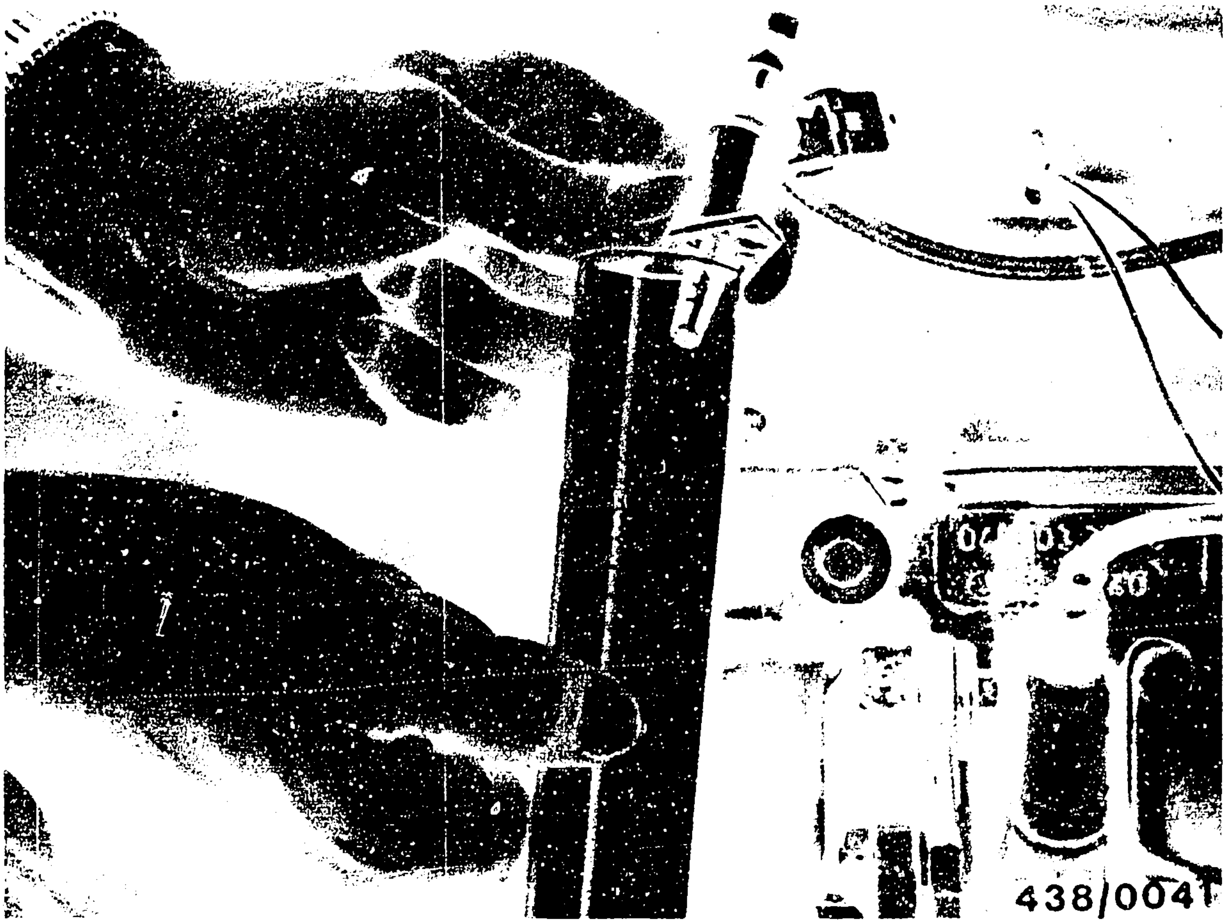
Screw a new threaded nozzle (short end) into the delivery nozzle using a thick flat seal and tighten to a torque of 17 ... 25 Nm.

Back up the delivery nozzle by holding a wrench on its hexagonal surface.

Slide a thin flat seal, banjo union and the other flat seal onto the long end of the threaded nozzle and tighten via the pressure damper.
Tightening torque: 17 ... 25 Nm

Reinstall the complete unit, making sure that the electric fuel pump is in the correct position.

Make sure there are no kinks in the fuel lines.



- <u>Cold-start valve leaks</u>

Remove the valve leaving the line connected.

Hold start valve in suitable container (e.g. graduate).
Switch on electric fuel pump by bridging safety circuit.
Dry off valve nozzle.
Fuel must not drip from the valve nozzle for a full minute.
The valve must remain leak-tight even when shaken and tapped.
Now switch off the electric fuel pump.
Replace the cold-start valve if it was not leak-tight.
Then perform idle adjustment with the engine at operating temperature.

The idle adjustment procedure is explained at coordinates F 18.

- <u>Stepping valve leaks</u>

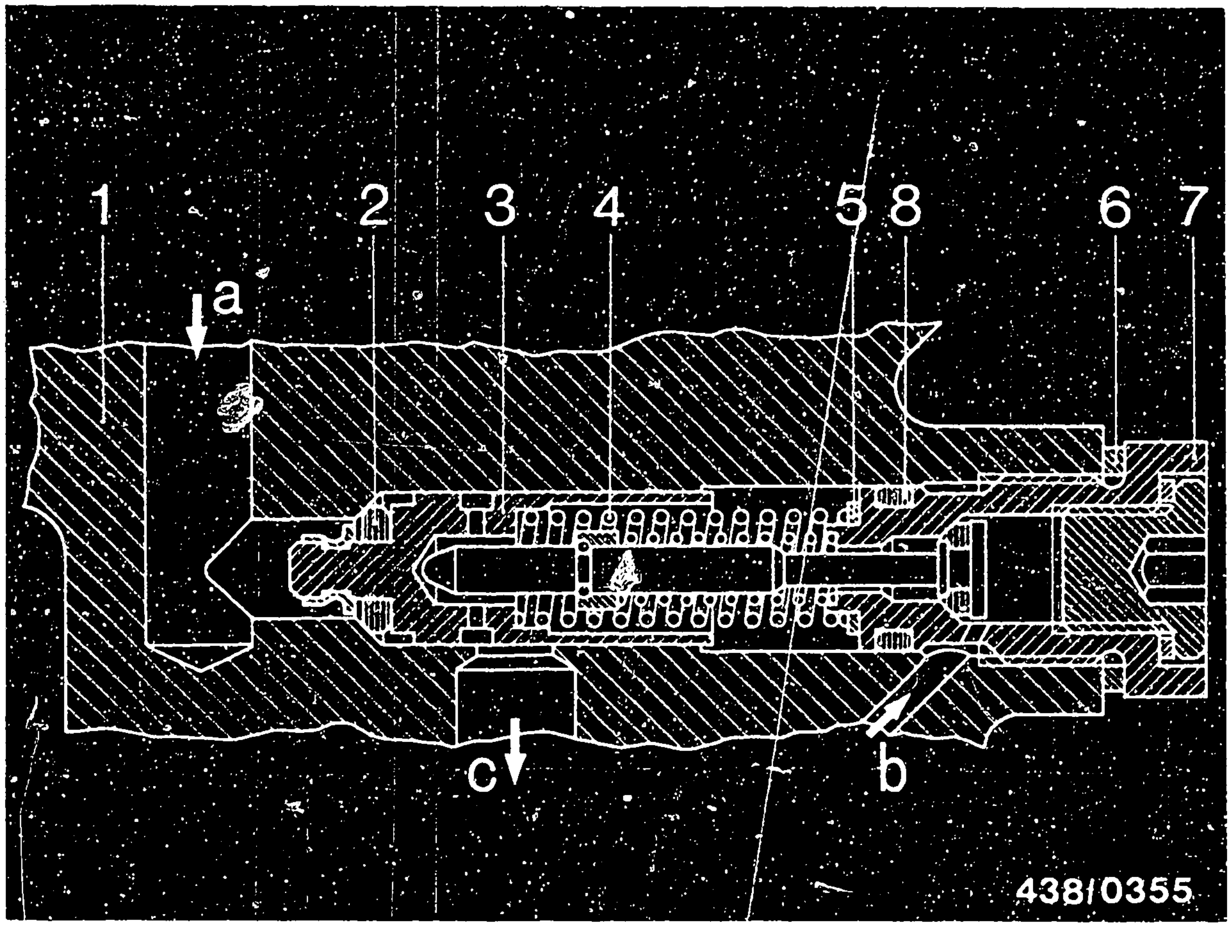
Remove the stepping valve return line at the junction and unplug the electrical connector.

Run the electric fuel pump by bridging the electrical safety circuit.

Dry off the fitting at the end of the line.

Fuel must not drip from the fitting for 1 minute.

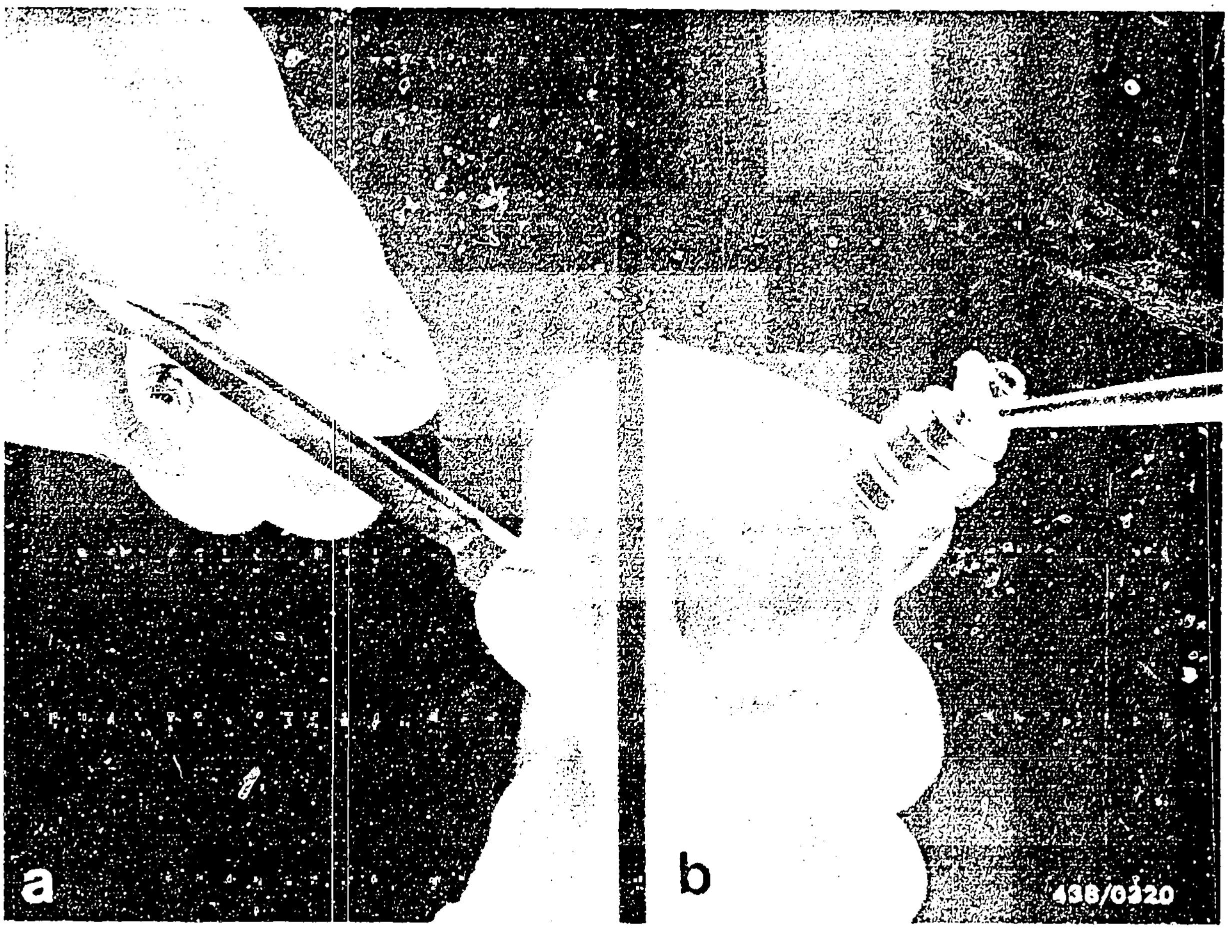
Turn off the electric fuel pump and replace the defective stepping valve.



a = Primary pressure
b = From the warm-up regulator
c = Fuel return outlet
1 = Fuel distributor housing
2 = Contoured seal
3 = Control plunger
4 = Control spring
5 = Shim(s)
6 = Flat seal
7 = Screw plug
8 = O-ring

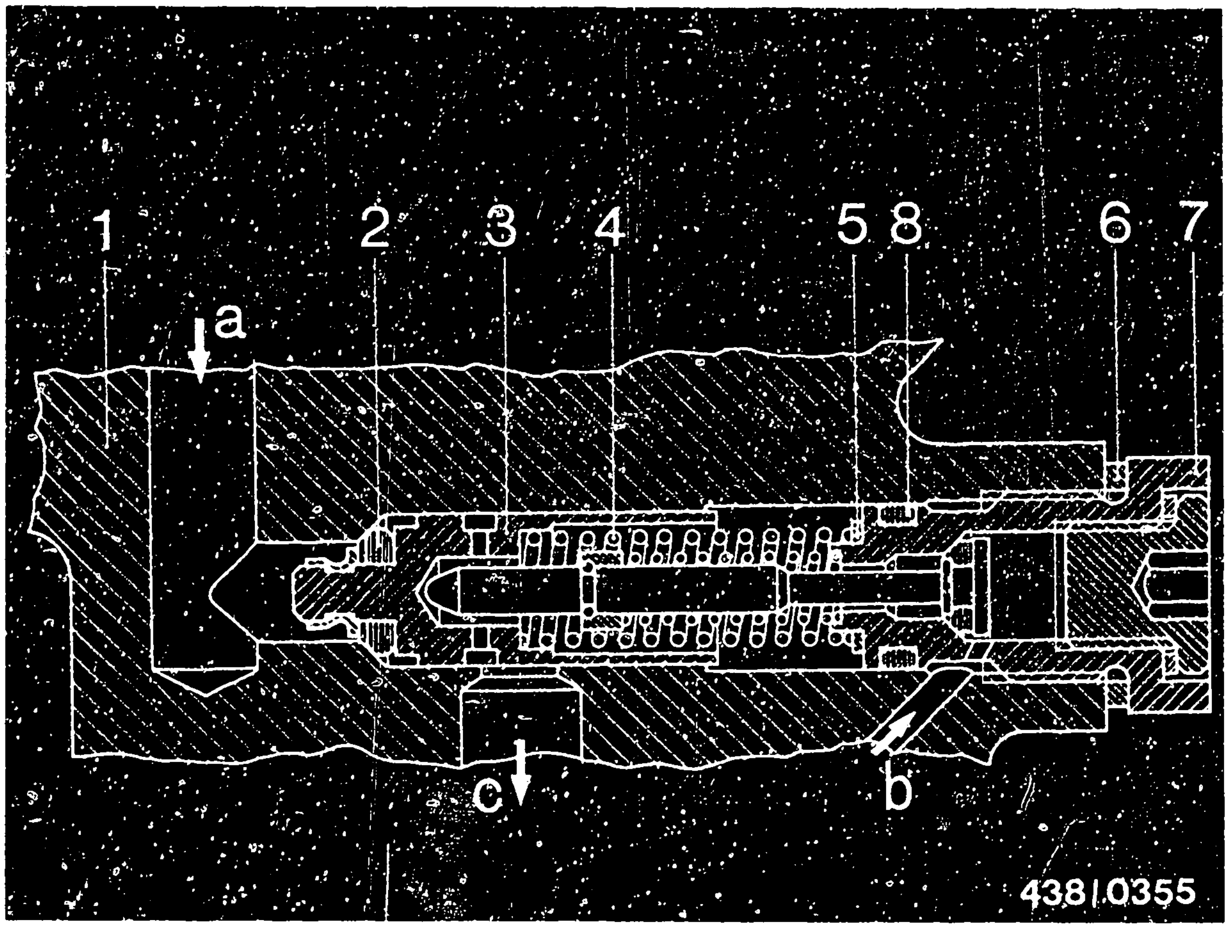
- Leaking contoured seal on control piston of primary pressure regulator

Replace contoured seal:
Clean the fuel distributor in the vicinity of the primary pressure regulator. Unscrew the large plug (7) with complete push valve. Also remove the shims (5), control spring (4) and control plunger (3).



The seal is replaced as follows without removing the retaining ring:
Cut the old seal apart and remove (Fig. a). Using a blunt marking tool, pull the new seal over the retaining ring (Fig. b). Do not overstretch the seal.

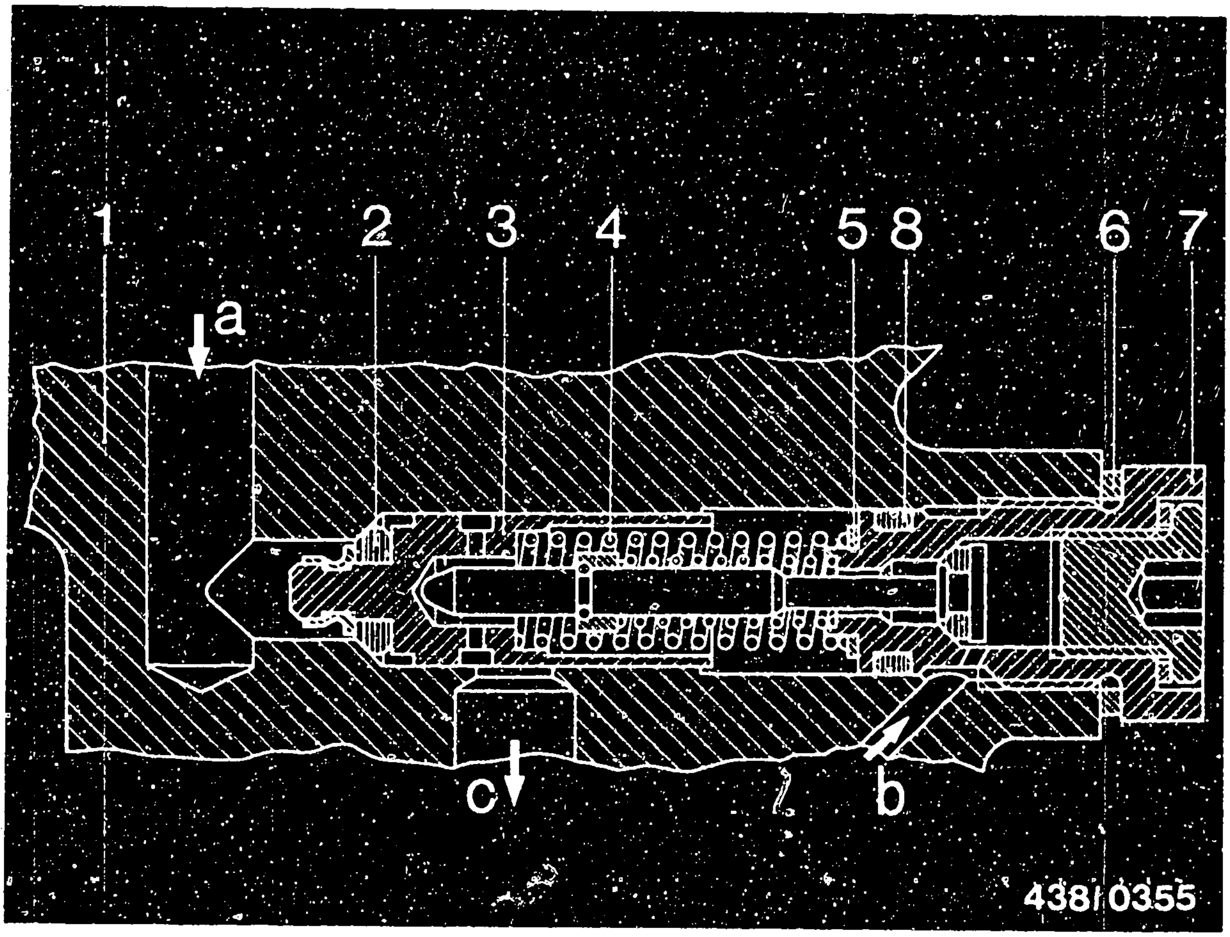
Then carefully check to make sure that the new seal is not damaged. The retaining ring must be loose enough to turn by hand. Check to make sure that there is a gap of approx. 0.2 mm between the retaining ring and the seal.



Then check the primary pressure and reset if necessary by replacing the shims (5).

Primary pressure test and setting values (gauge pressure)

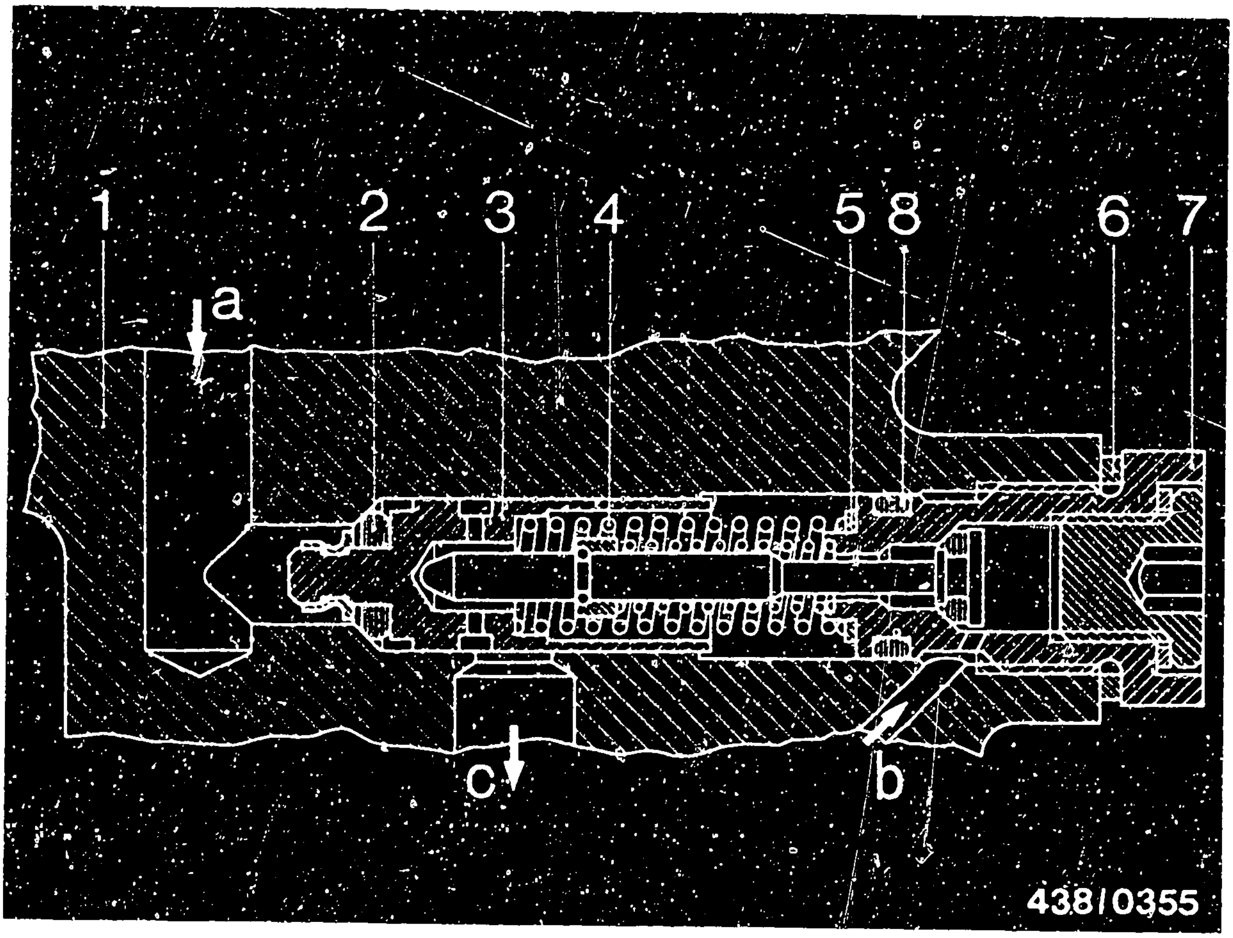
Fuel distributor order number:	Test values:	Setting values:
0 438 100 127	4.7 ... 5.4 bar (4.8...5.5 kp/cm²)	4.9 ... 5.1 bar (5.0...5.2 kp/cm²)



a = Primary pressure
b = From the warm-up regulator
c = Fuel return outlet
1 = Fuel distributor housing
2 = Contoured seal
3 = Control plunger
4 = Control spring
5 = Shim(s)
6 = Flat seal
7 = Screw plug
8 = O-ring

16.5 Possible faults in the control pressure circuit

Leaking push valve in the primary pressure regulator. The seal in the push valve is vulcanized onto the valve needle.



For this reason, if leaks are found replace the entire push valve as a complete unit.

Clean the fuel distributor in the vicinity of the primary pressure regulator. Unscrew the large plug (7) with complete push valve. Be careful not to lose the control spring (4) and shims (5).
Install a new push valve with the same number of shims (5), new O-ring (8) and flat seal (6).
Then recheck the primary pressure and set if required by replacing the shims (5).

System pressure test and setting values (gauge pressure

Fuel distributor order number:	Test values:	Setting values:
0 438 100 127	4.7...5.4 bar (4.8...5.5 kp/cm²)	4.9...5.1 bar (5.0...5.2 kp/cm²)

17. Checking the injection valves

Remove the injection valves.
Back up the injection valves at their hexagonal surfaces when unscrewing the fuel lines.
In order to ensure leak-tightness and prevent the entrance of unmetered air, reinstall the injection valves with new O-rings on the valve stems if possible (order No. 3 430 210 600).
Also check the insulating sleeves for leaks. If necessary, tighten using a hexagonal offset wrench (11 mm).

17.1 Test equipment and fluids

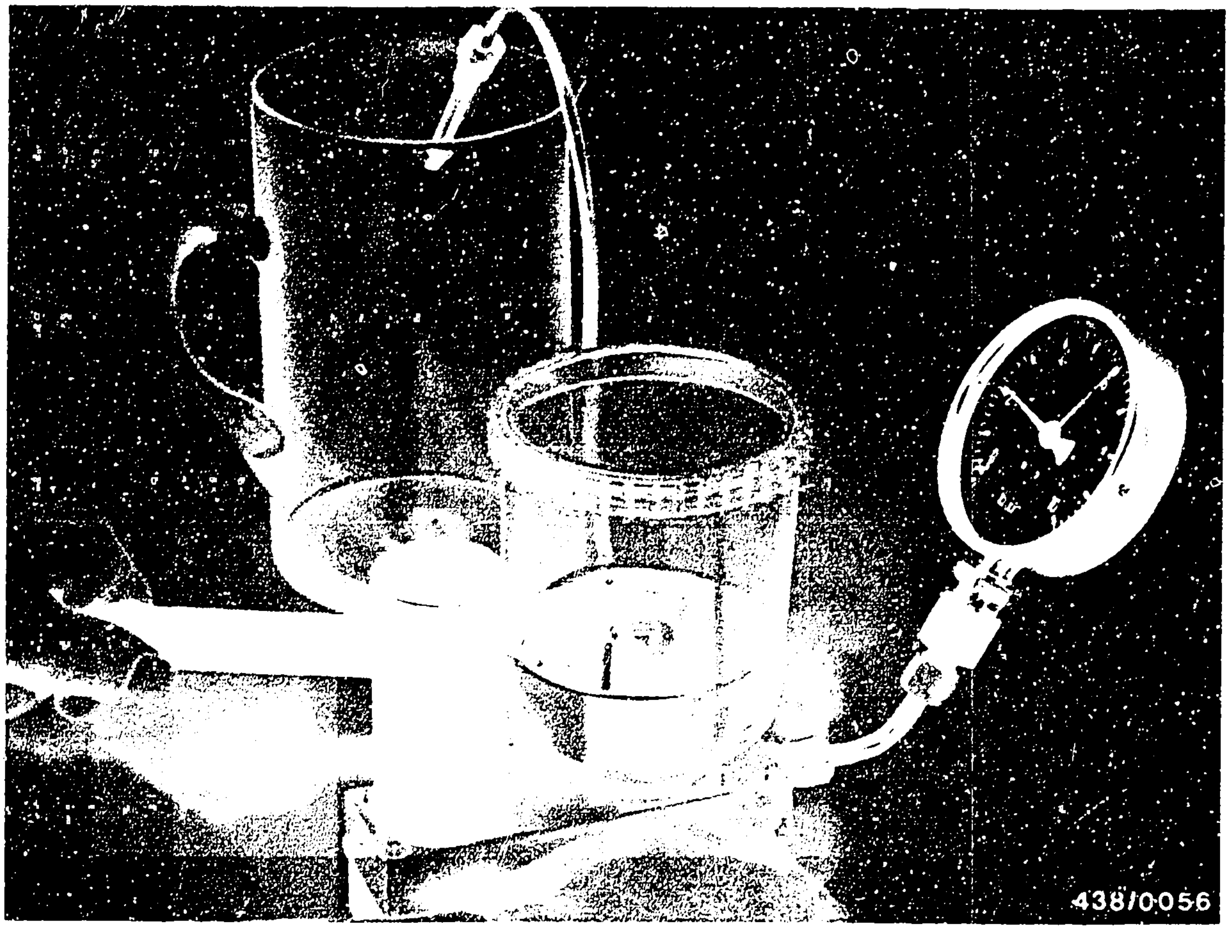
The following test specification applies to valve testers of Type KDJE-P 400 (formerly KDEP 7452) and 0 681 200 700.

Follow the test specification!

Test fluids: White spirit (Shell K 30, Esso-Varsol, Shell Mineral Spirits 135)
or
Bosch, order designation VS 14 942 - CH
formerly order number 5 973 340 650
White spirit is available in 5-liter containers from the following company:
Oskar Gnamm GmbH & Co.
D-7531 Kaempfelbach-Bilfingen, W. Germany

Caution!

For reasons of safety, gasoline or similar highly-flammable or combustible liquids must never be used.
Follow local official regulations even when using white spirit.

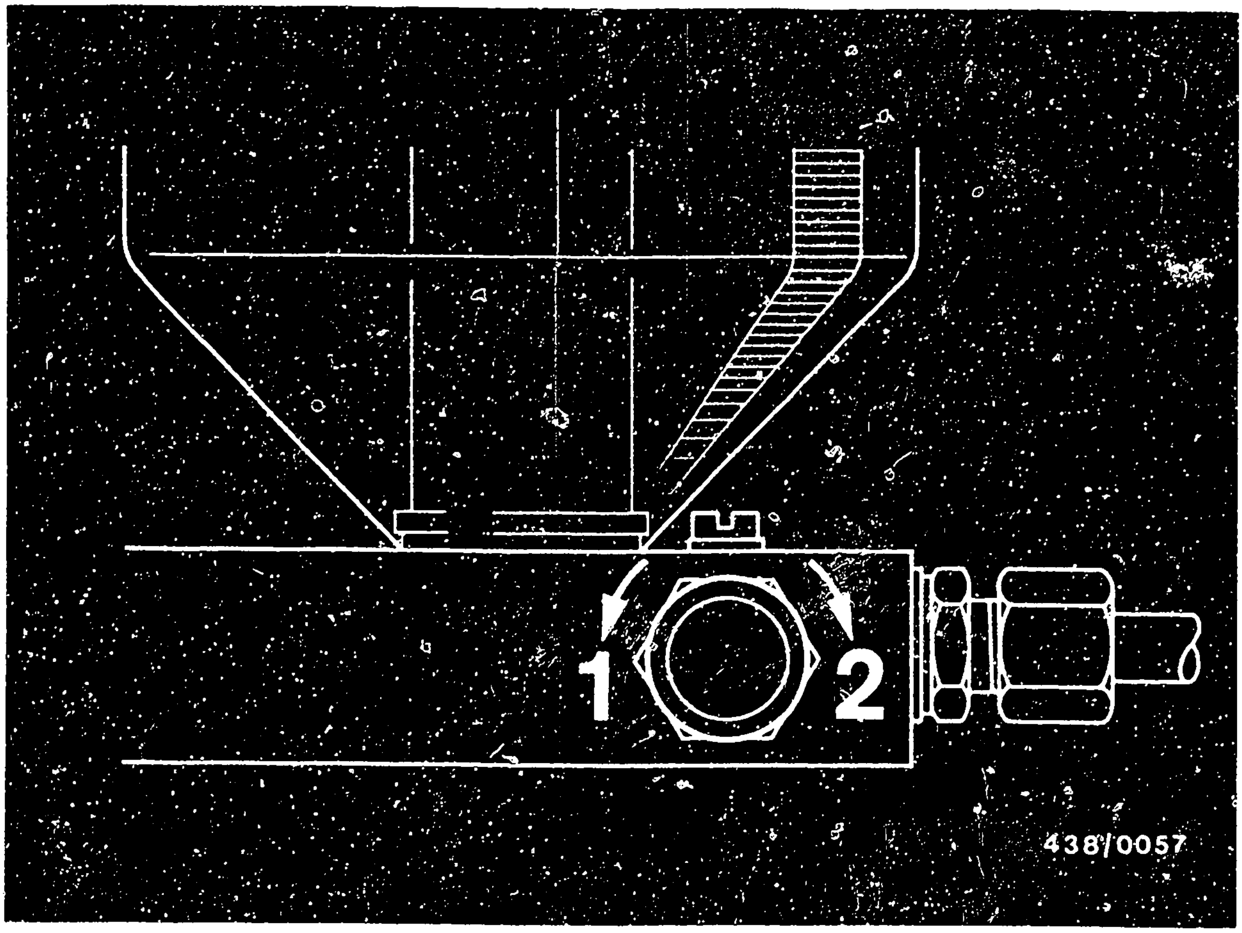


17.2 Connecting the injection valves to the valve tester

Connect the injection valve under test to the valve tester and bleed the delivery line by opening the union nut and operating the handle several times. Then retighten the union nut.

17.3 Checking for contamination

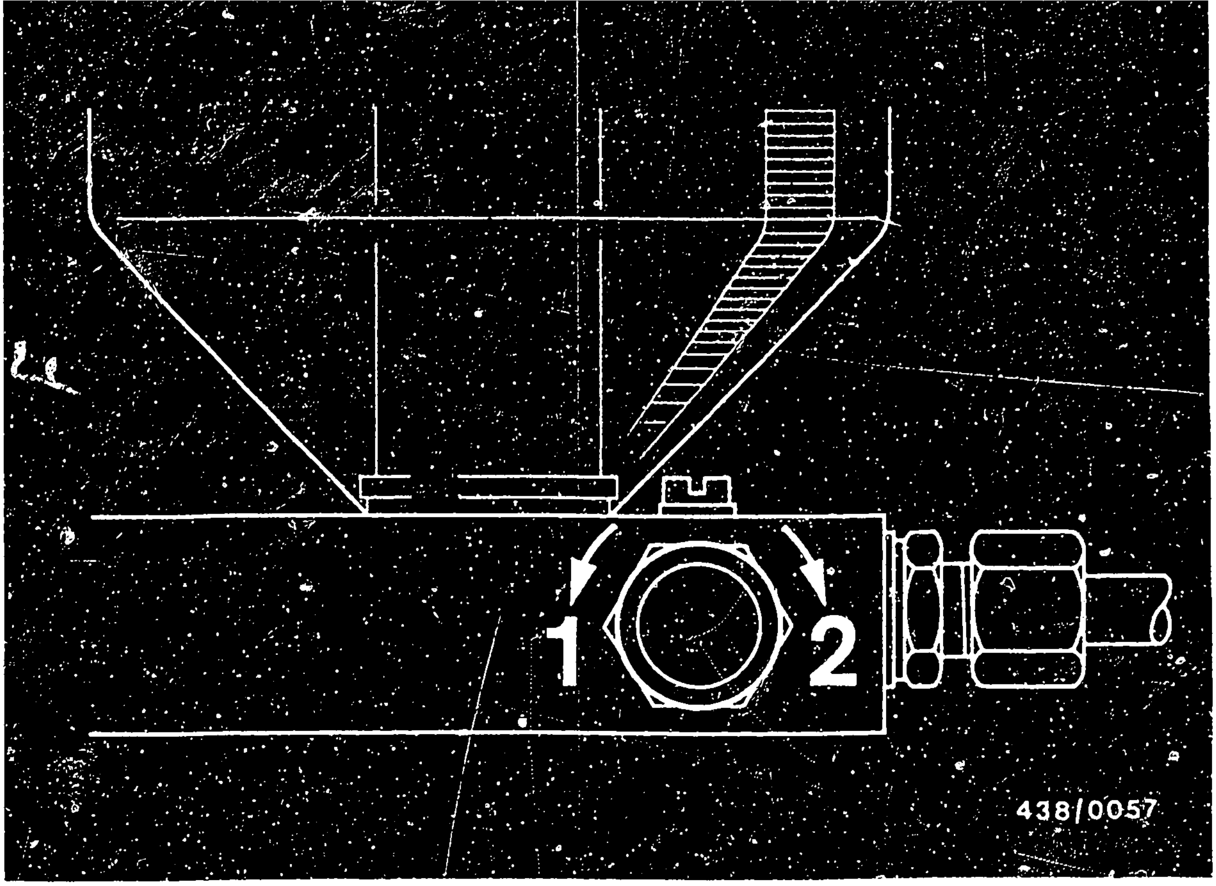
With the pressure gauge stopcock open, operate the lever slowly (approx. 2 s/stroke). If a pressure build-up of 1...1.5 bar gauge pressure does not occur, the injection valve has a major leak (caused by trapped particles of dirt, for example). If it is possible to flush out the dirt by several powerful strokes of the lever, continue the test. If no improvement is noted, discard the injection valve.



1 = Open 2 = Closed

17.4 Checking the opening pressure

Injection valve order number	Test values for opening pressure (gauge pressure)
0 437 502 023 0 437 502 024	3.0...4.1 bar (3.1...4.2 kp/cm²)



Flush and bleed the injection valve by operating the lever quickly several times with the stopcock closed. Open the stopcock and check the valve opening pressure while operating the lever slowly (approx. 2 s/stroke).

If the opening pressure is out of tolerance, replace the injection valve. Individual valves within a set can also be replaced.

17.5 Leak test

Open the stopcock and increase pressure to 0.5 bar below the opening pressure determined above (however not more than 2.8 bar gauge pressure) and hold this pressure. The valve must not drip for a period of 20 s.

438/0058

17.6 Chatter test, spray evaluation

Lever speed: approx. 1 stroke/s

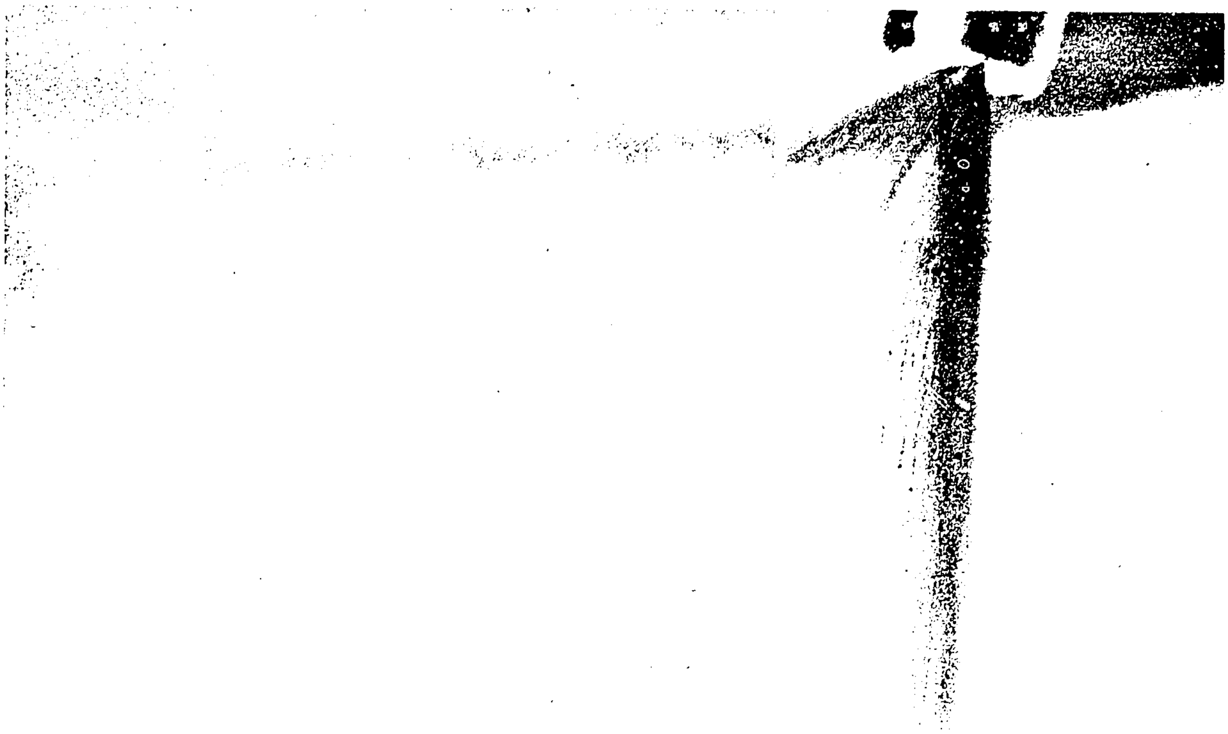
The valve must chatter.

Test fluid must not drip from the valve opening.

The spray pattern must not be a thin line.

Spray which is atomized on one side within an overall discharge angle of approx. 35° is permissible (see illustrated examples).

The above photograph shows a good spray pattern.



438/0059

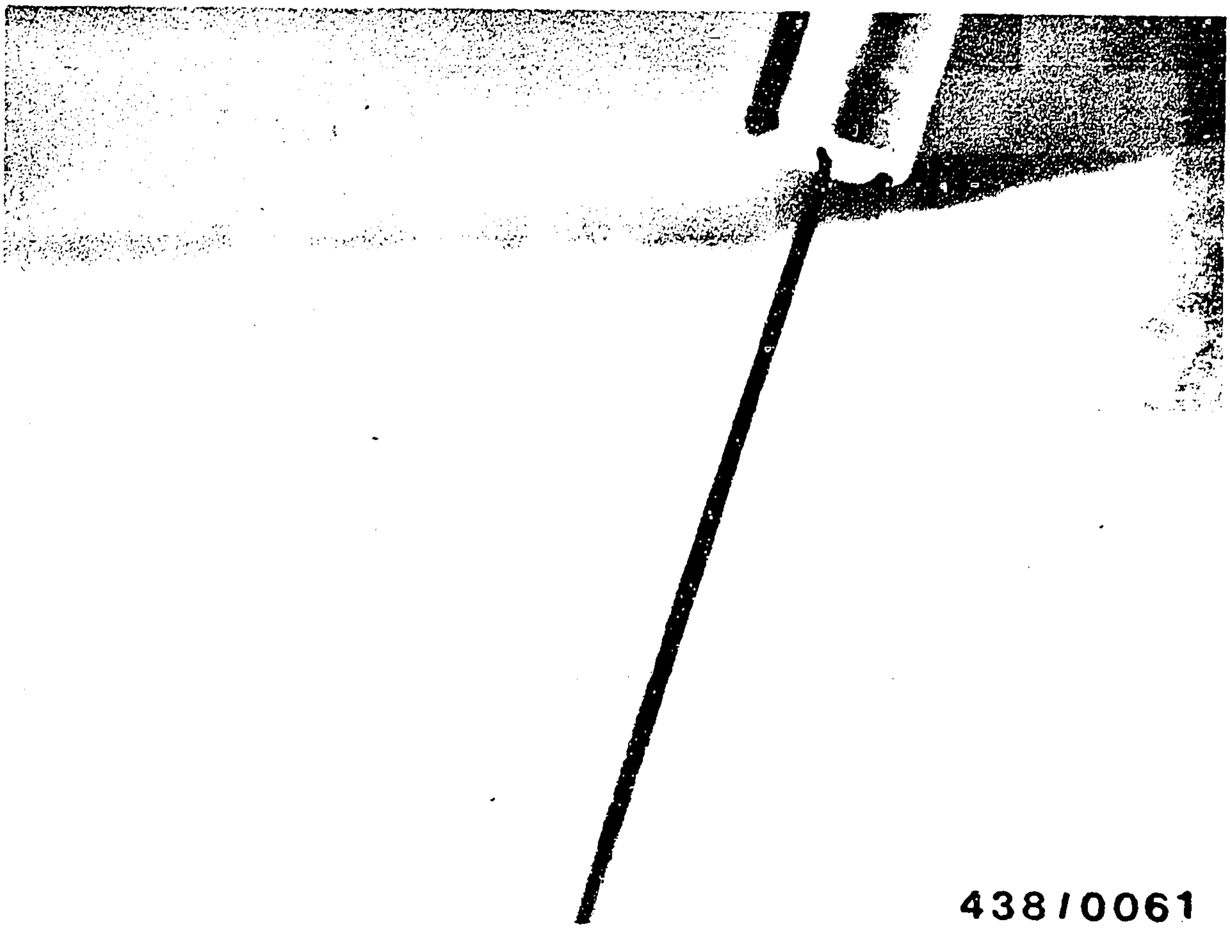
The above photograph shows a good spray pattern, although it is single-sided.

438/0060

Poor spray pattern.

Discard injection valve.

The above photograph shows droplet formation.

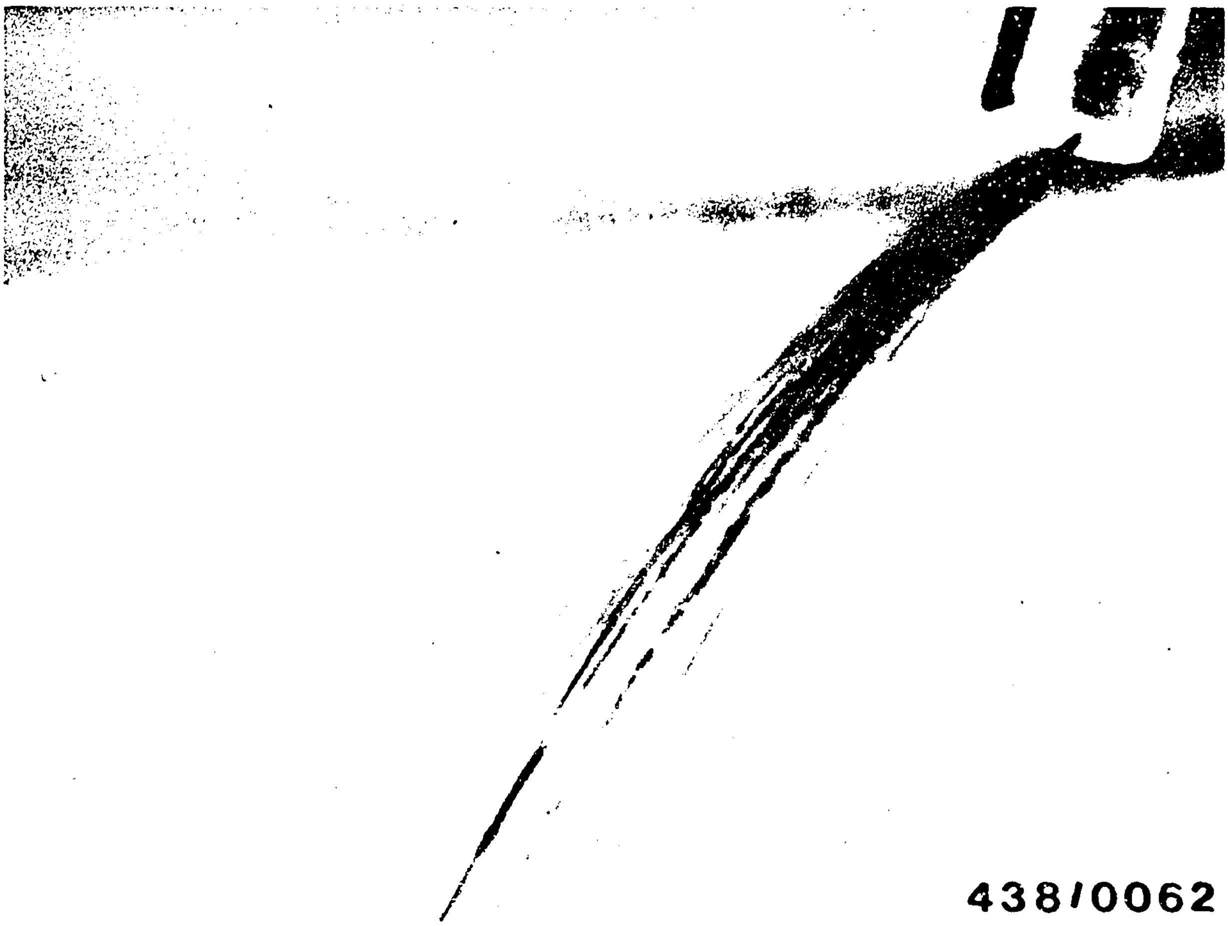


438/0061

Poor spray pattern.

Discard injection valve.

The above photograph shows a thin line spray pattern.



438/0062

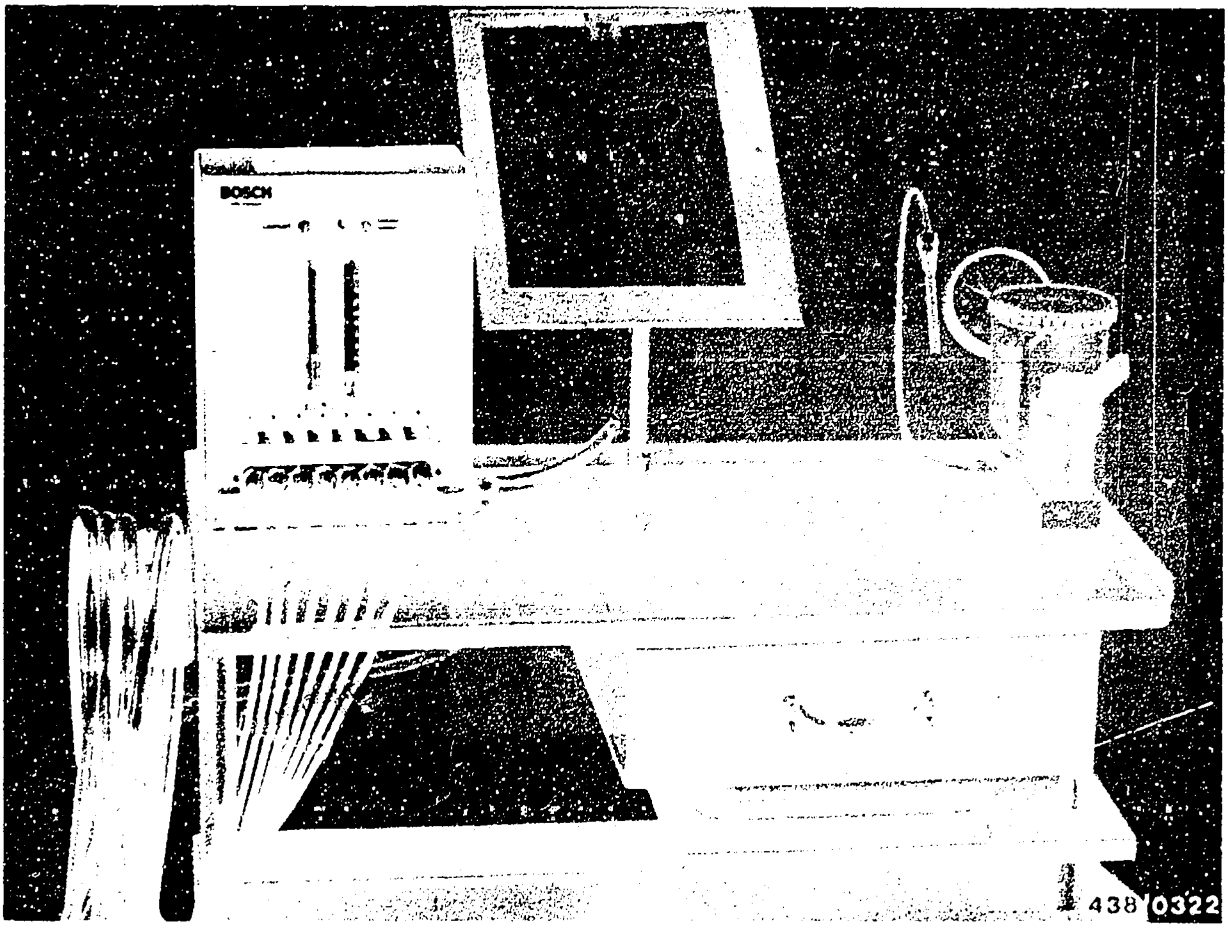
Poor spray pattern.

Discard injection valve.

The above photograph shows a coarse spray pattern.

If defective injection valves are replaced, the idle speed must be reset with the engine at operating temperature.

The idle adjustment procedure is explained at coordinates F 18.



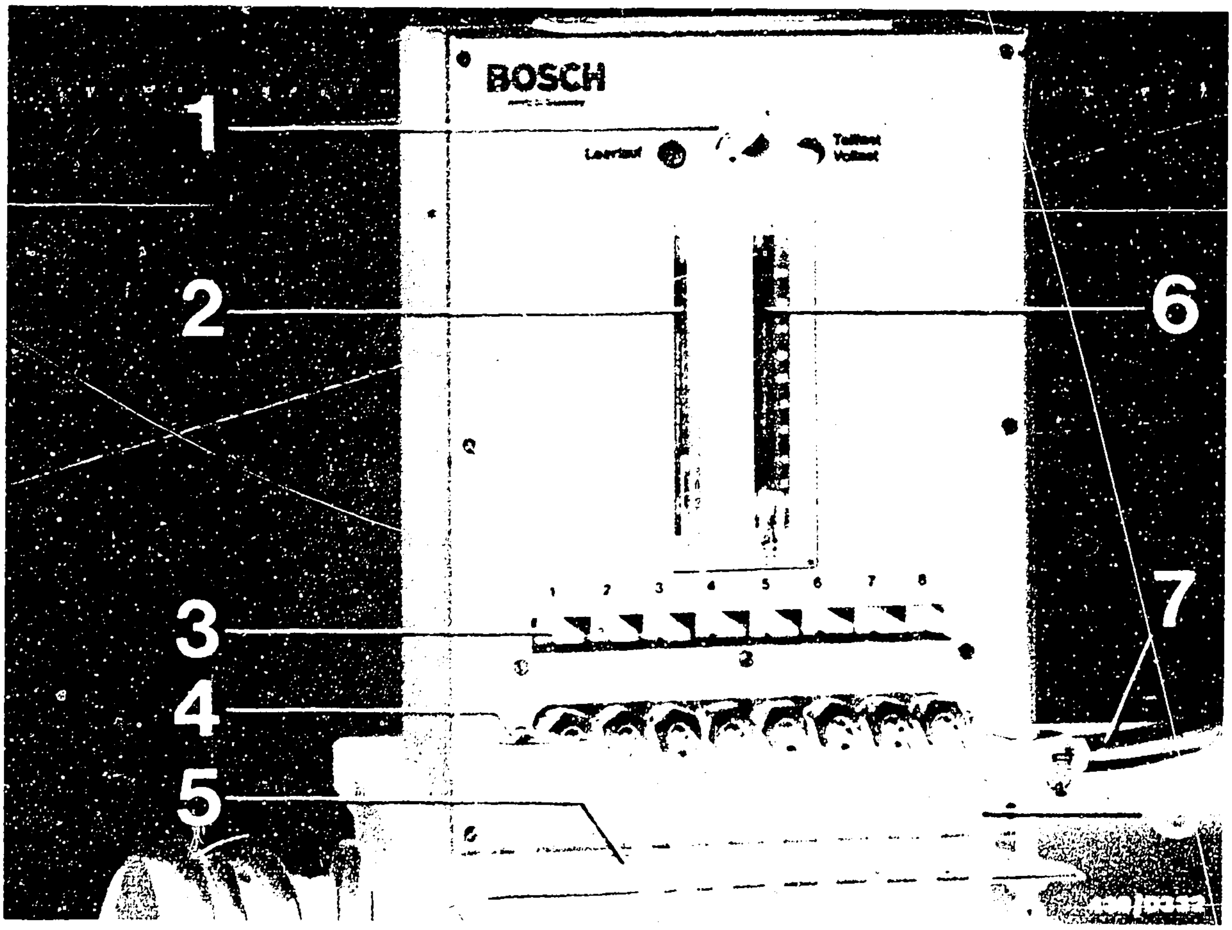
18. Comparison of delivered quantities of fuel distributor outlets

Use tester for delivered quantity comparison KDJE-P 200 (formerly KDJE 7451).

18.1 Application

The delivered quantities of the individual fuel distributor outlets are compared against one another. The tester is designed such that this comparison can be made on the vehicle without removing the fuel distributor.

Because the test is performed using the injection valves from the vehicle, a determination can simultaneously be made as to whether or not any dispersion is due to the fuel distributor or the injection valves.



1 = 3-way changeover valve
2 = Small graduated measuring tube
3 = Keys for 8-way valve
4 = Adjustment screws for setting up tester
5 = Bubble level
6 = Large graduated measuring tube
7 = Fuel return line
8 = Polyamide tubes (test lines)

18.2 Tester design

The tester is designed for all engines equipped with K-Jetronic systems, including 8-cylinder models.

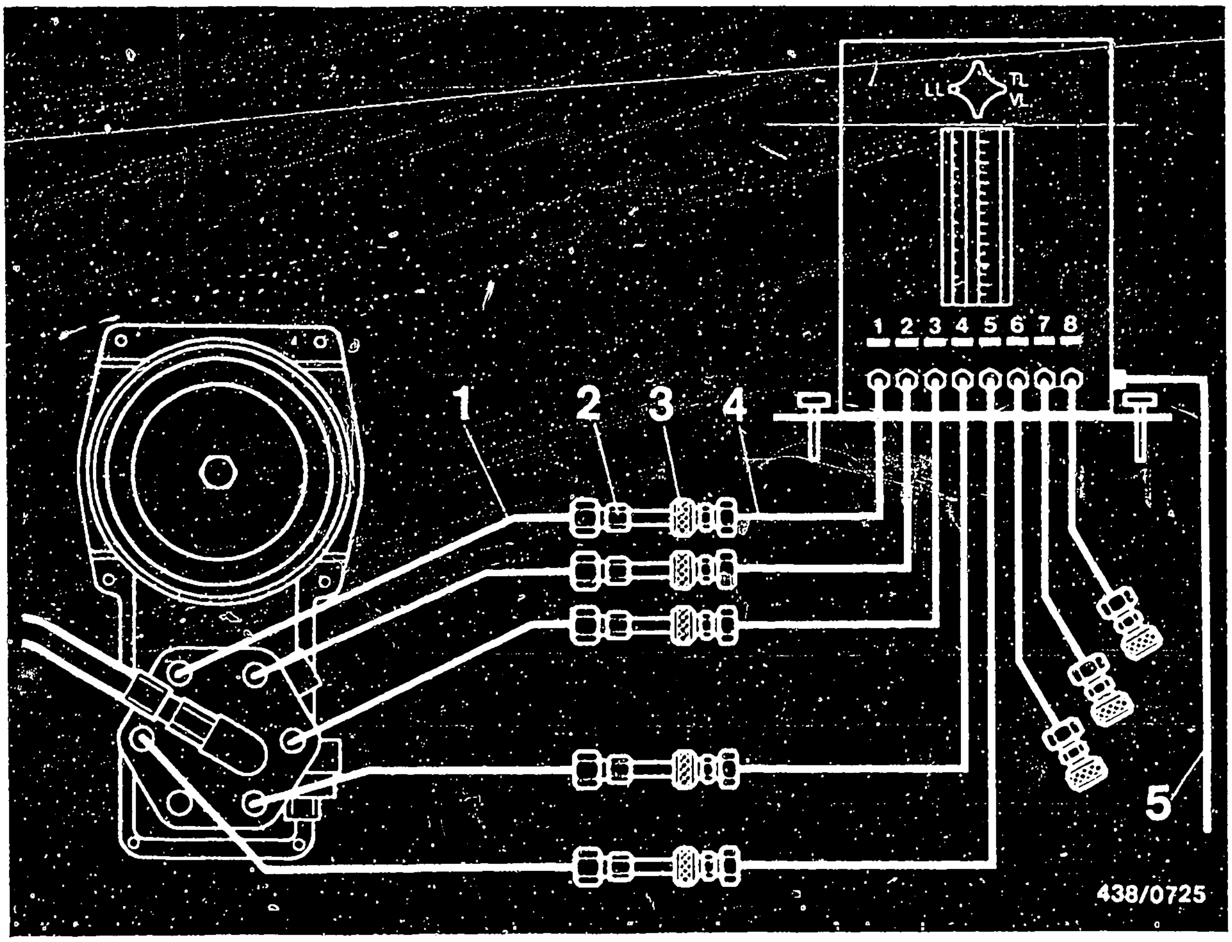
The sheet-steel housing contains 2 rotameter tubes with measuring ranges of 2...15 cm^3/min and 10...180 cm^3/min, an 8-way valve which is key-operated (3) and a 3-way cock (1).

The small rotameter tube (2) is used for idle measurement, and the larger tube (6) is used for measuring the delivery rate under part-load and full-load conditions. The 3-way cock is used to select either of the two tubes. The 8-way valve is used to sequentially select the delivery rates of the individual cylinders.

Eight hoses (8) are attached to the unit. The hoses have snap-on couplers which accept the injection valves after they have been removed from their holders on the engine. Each snap-on coupler has a push valve so that no fuel can escape from unused lines (when testing 4- or 6-cylinder systems).

A hose (7) approx. 5 m long returns the fuel to the fuel tank.

A closed-circuit test system is used so that no fuel escapes to the outside.



1 = Fuel distributor injection lines
2 = Injection valves
3 = Snap-on couplers
4 = Tester hoses
5 = Return line to the fuel tank filler neck

18.3 Setting up and connecting the delivered quantity comparison tester

Place the tester on a solid foundation next to the vehicle (e.g on tester cart KDJE-W 100) and level the unit using the bubble level on the tester baseplate.

Remove injection valves leaving injection lines attached.
Clean injection valves using a rag and insert them in proper sequence into the snap-on couplers of the first five tester lines.

N o t e :

Insert the injection valves as far as they will go and securely tighten the knurled nuts so that the check valves in the snap-on couplers open completely.
Place the return hose from the tester in the fuel tank filler neck.

18.4 Bleeding the delivered quantity comparison tester

Remove the rubber cover (loosen the 2 clamping bands) to provide access to the sensor plate.

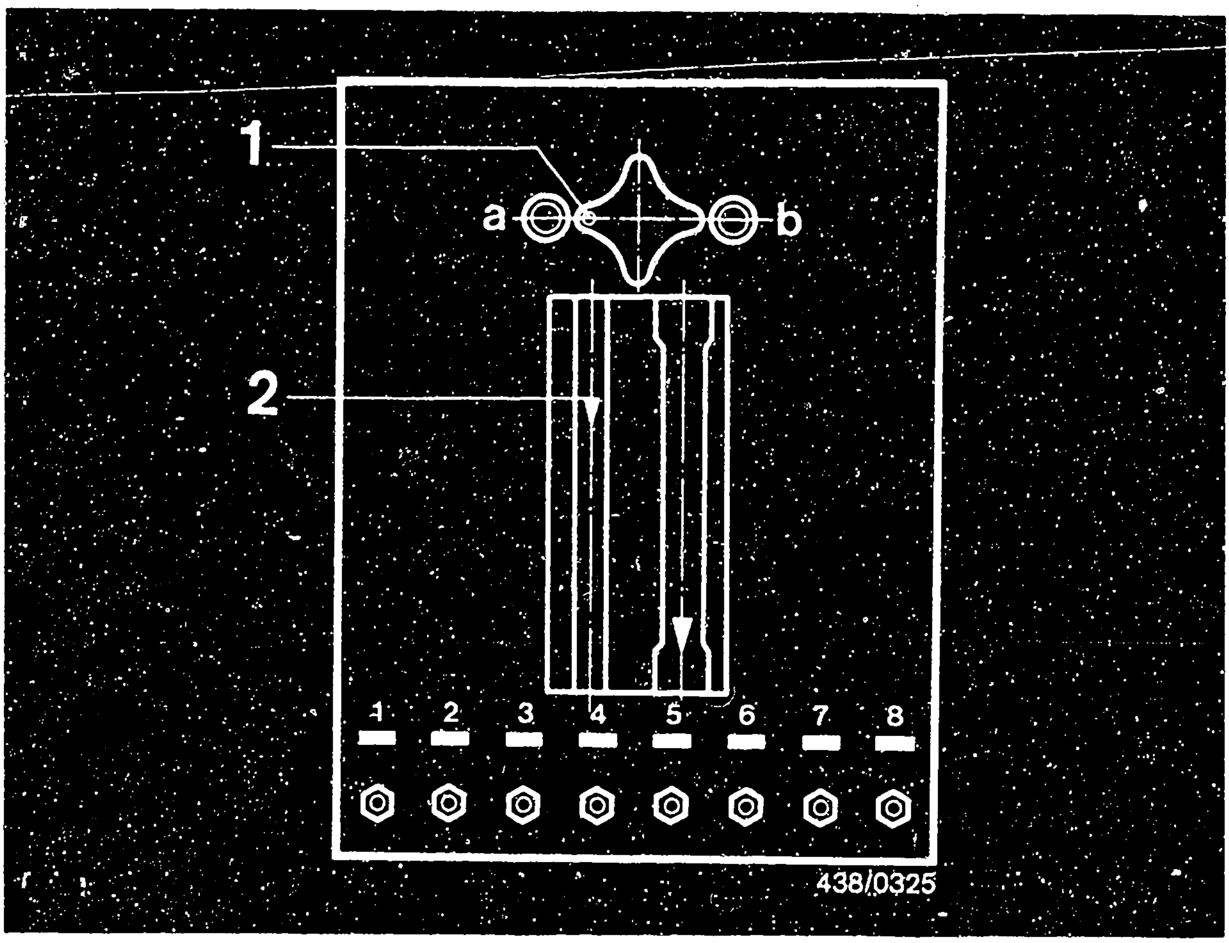
Unplug the electrical connector of the warm-up regulator.

Run the electric fuel pump by bridging the electrical safety circuit.

Lift the sensor plate of the air flow sensor until it stops.

Press the keys of the 8-way valve one after the other and turn the 3-way changeover cock several times until both measuring tubes have been bled.

Return the sensor plate to its rest position.



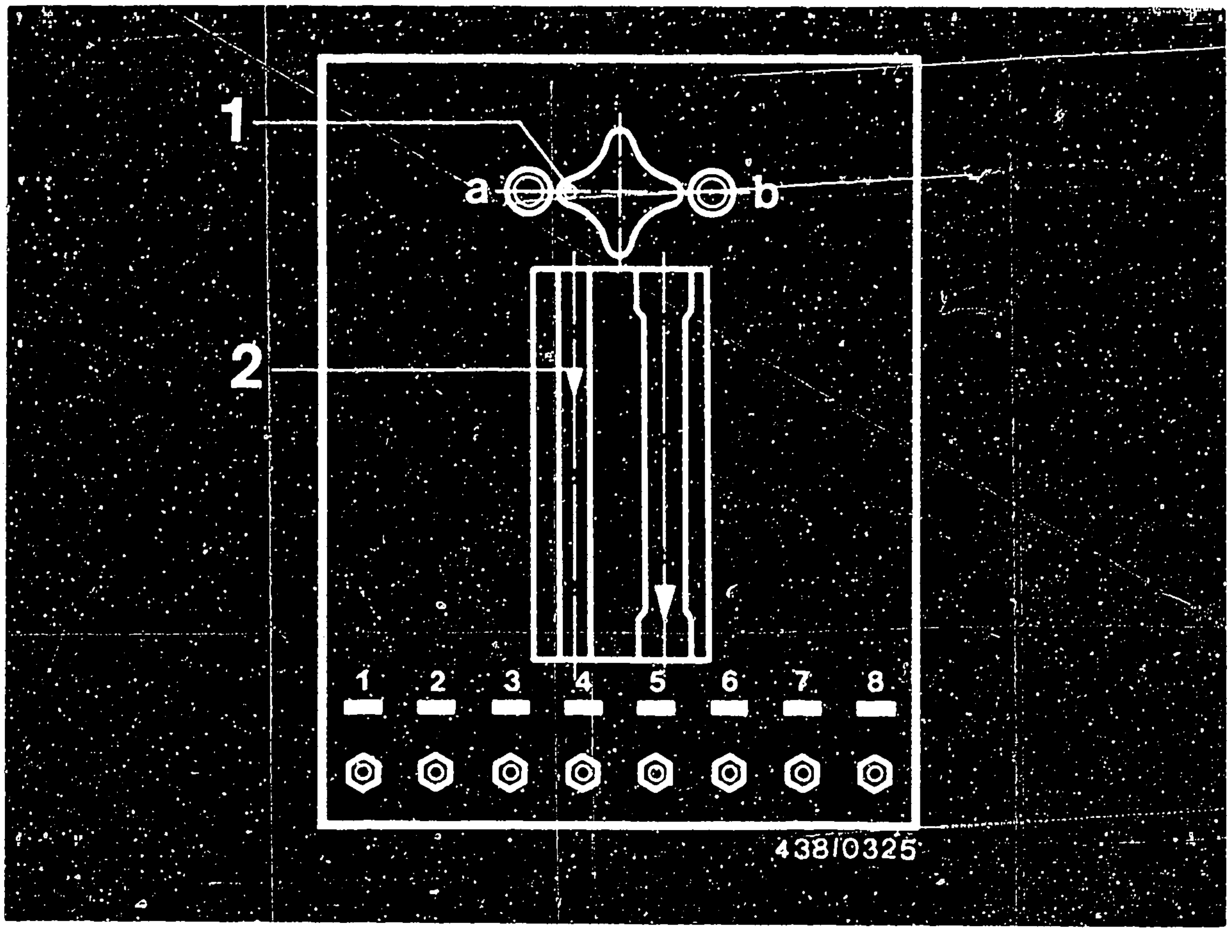
1 = White dot
2 = Measuring line

a = Idle
b = Part load / full load

18.5 Test procedure

The delivered quantity comparison is made in the idle, part-load and full-load ranges.

Turn the selector knob so that the white dot points to the left to select the small measuring tube for the idle range, and to the right to select the larger measuring tube for the part-load and full-load ranges.



1 = White dot
2 = Measuring line

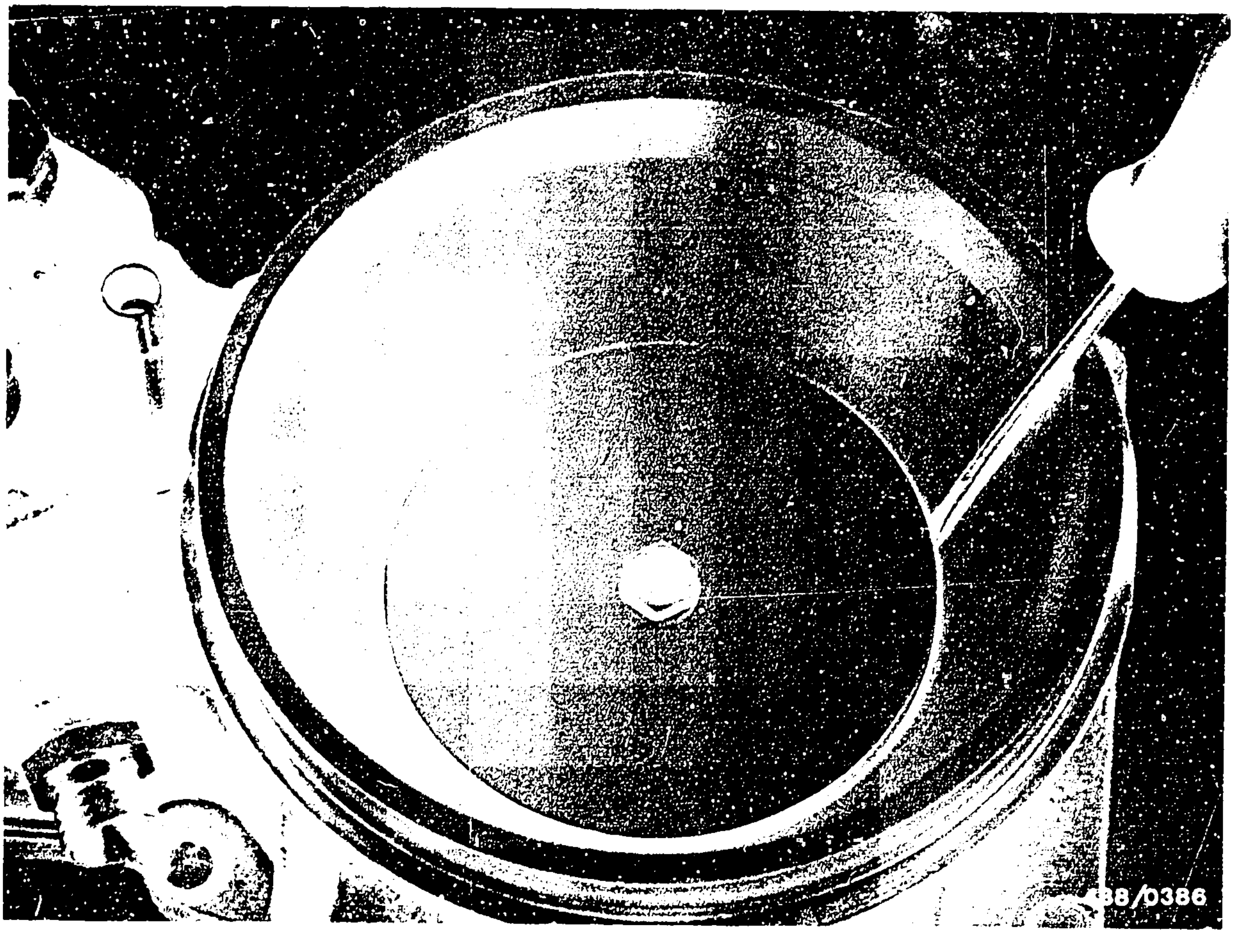
a = Idle
b = Part load / full load

The delivery rate indicated by the rotameter tubes is read off at the top edge of the floating cone (2).

In units which have floating balls, the delivery rate is read off at the highest point on the ball.

In making each measurement, wait until the floating cone or ball has reached its final position.

At low delivery rates this can take between 20 and 30 seconds.



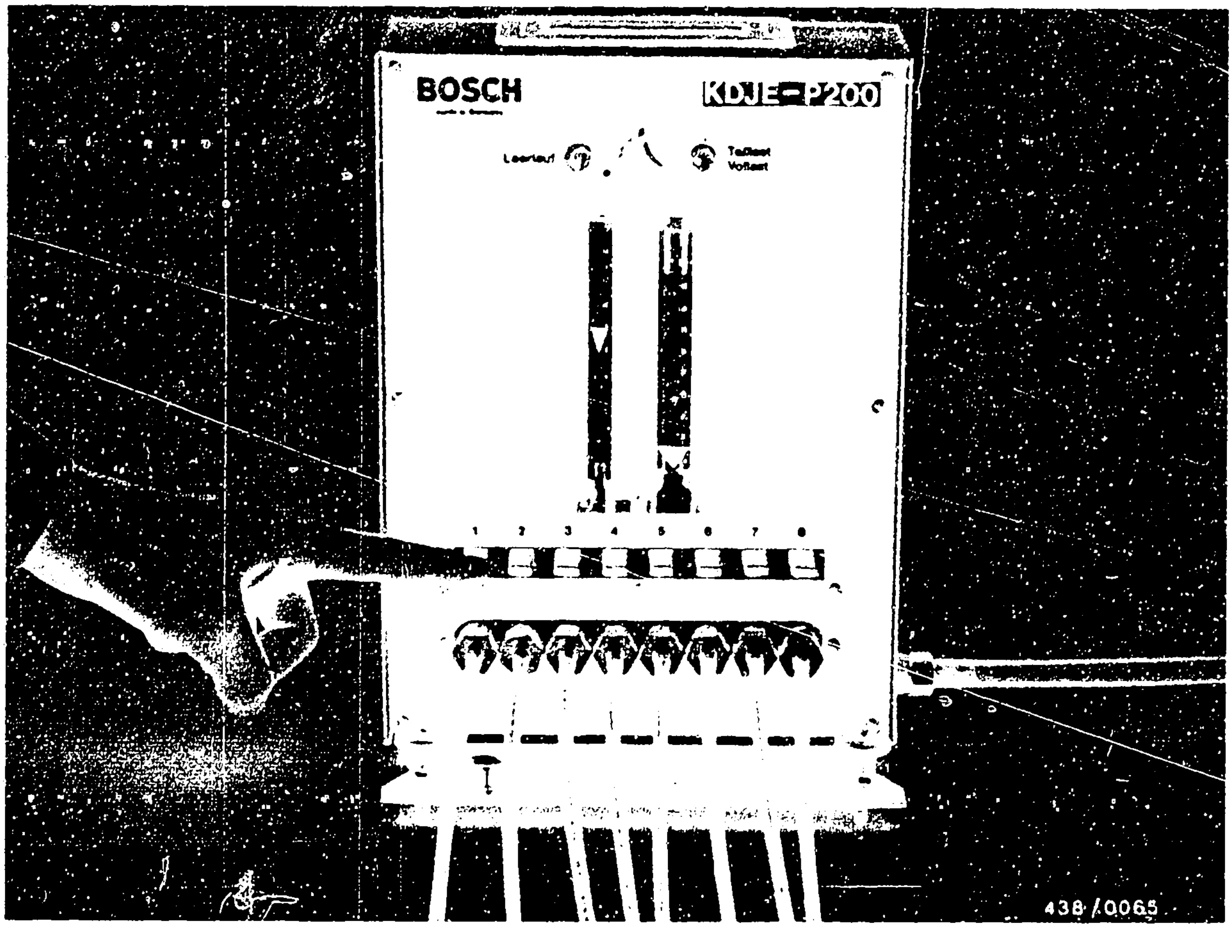
The sensor plate is positioned and held in place for the various load ranges by means of a screwdriver (a small one for the idle position) which is inserted to the appropriate depth between the cone and the sensor plate.

Test procedure

Run the electric fuel pump by bridging the safety circuit.

The following section contains the maximum permissible delivered quantity deviations for the individual load ranges.

The value given as the "setting point" always refers to the fuel distributor outlet with the lowest delivery rate, i.e. first determine the outlet with the lowest delivery rate.



Press the key for outlet 1. Deflect the sensor plate until the corresponding rotameter tube approximately indicates the "setting point".
Fix the sensor plate in that position.

Check the remaining outlets in order to determine which outlet has the lowest delivery rate.

Press the key for this outlet again, and correct the sensor plate position so that the delivery rate corresponds exactly to the "setting point", and again fix the sensor plate in this position.

Press the remaining keys one after the other, and determine the maximum delivery rate of each outlet. Differing delivery rates can only be higher than the "setting point".

18.6 Test values

Fuel distributor order number	Setting point	Maximum permissible delivery rate
0 438 100 127	(cm³/min)	(cm³/min)
Idle	6.0 cm³/min	6.6 cm³/min
Part load	40.0 cm³/min	43.0 cm³/min
Full load	140.0 cm³/min	155.0 cm³/min
This full-load delivery rate must be achieved or exceeded with the sensor plate at maximum deflection.		

If excessive deviations are found in one of the three load ranges, repeat the test a second time.

If the results of the second test are the same as those of the first, determine whether the fault lies with the fuel distributor or the injection valves.

To do this, switch the injection valves with the highest and lowest delivery rates.
If the test result remains the same, the fuel distributor is defective. If the fault follows the switched injection valves, the injection valves are defective.
Replace the defective fuel distributor or injection valves.

18.7 Concluding work

Inspect the seals on the injection valve stems for damage and deformation, and replace if necessary (order number 3 430 210 600).

Also check the insulating sleeves. If necessary, tighten using a hexagonal offset wrench (11 mm).

Properly reinstall the injection valves. Replace the rubber cover. Make sure all lines are routed correctly.
Enable the K-Jetronic electrical safety circuit (replace relay). Test run the engine and check to make sure that all line connections are leak-tight.

Then check the idle adjustment and reset if necessary.

The idle adjustment procedure is explained at coordinates F 18.

19. Idle adjustment

19.1 General requirements for all models:

- Run the engine up to temperature.
  (oil temperature: approx. 80°C).

Important note:

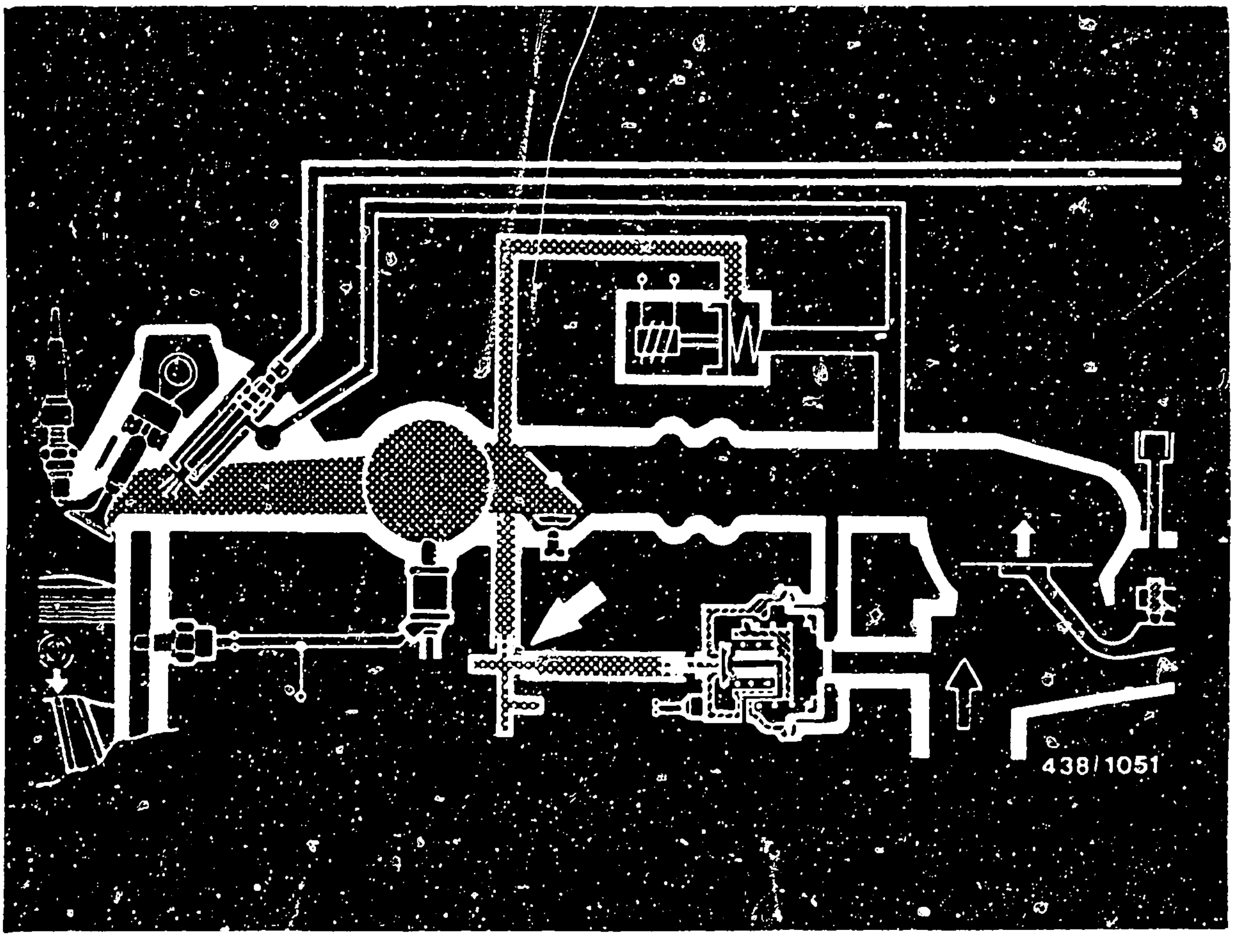
- If injection lines or injection valves were loosened or removed, run the engine up to temperature under load. The low volume of fuel flowing at idle is not always sufficient to bleed the injection lines.
- Do not adjust the idle speed when the engine is too hot, e.g. immediately after hard driving or after the engine has been performance-tested on the roller-type test stand.
- Turn off the air conditioner (if equipped) before adjusting the idle speed due to the speed stabilization system.
- Measure engine speed with a separate tachometer.

Additional requirements prior to adjusting the idle speed and setting the CO value:

- Check to make sure that the throttle valve lever is resting against the idle stop. In this position, the bowden cable must not be taught.

- These engines come with overrun fuel cutoff systems as standard equipment. This system must be disabled in order to adjust the idle speed and set the CO value.

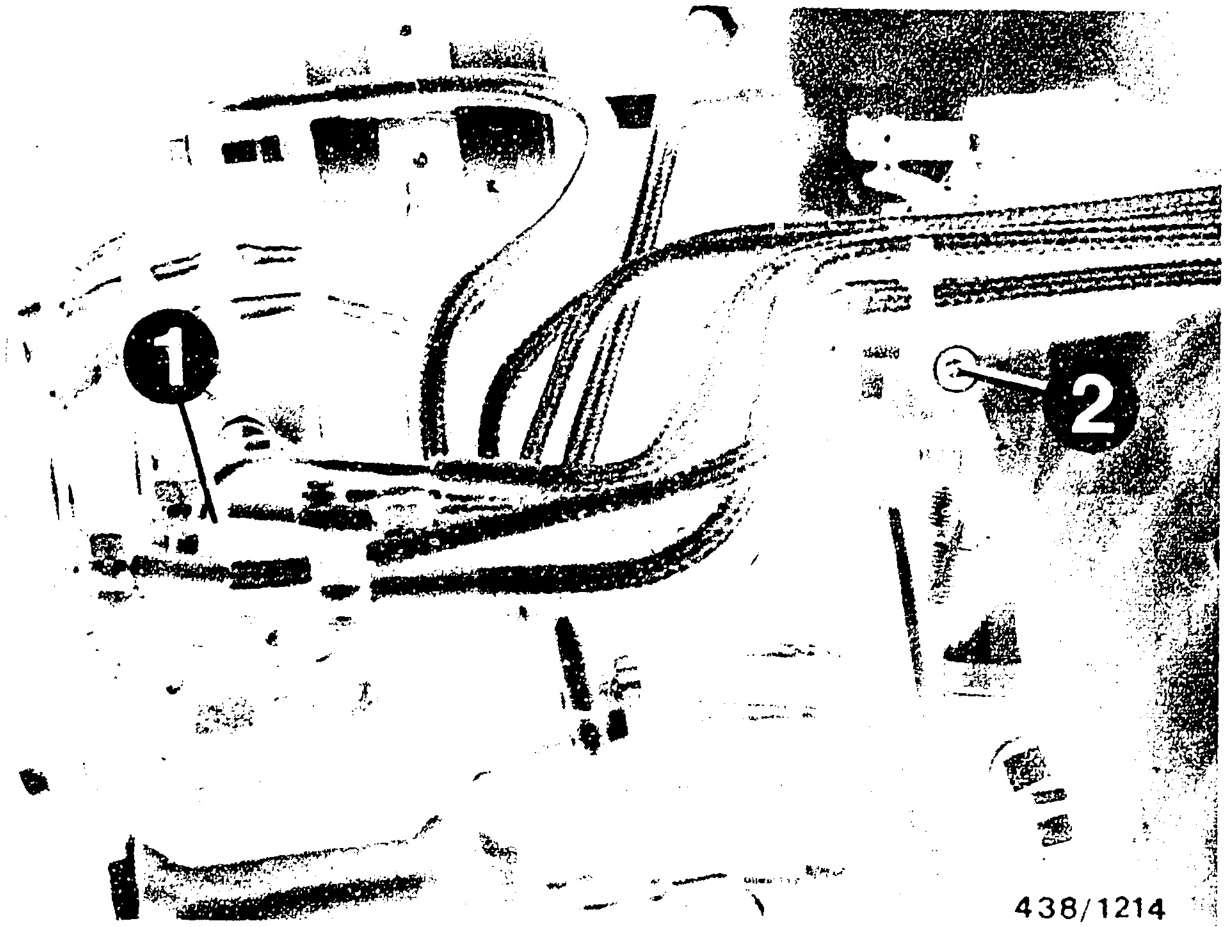
  The following coordinate explains how to disable this system.



19.2 Disabling the overrun fuel cutoff system

Remove the hose from the manifold pressure branch (arrow).

Tightly close off the end of the hose and the nipple of the manifold pressure branch.

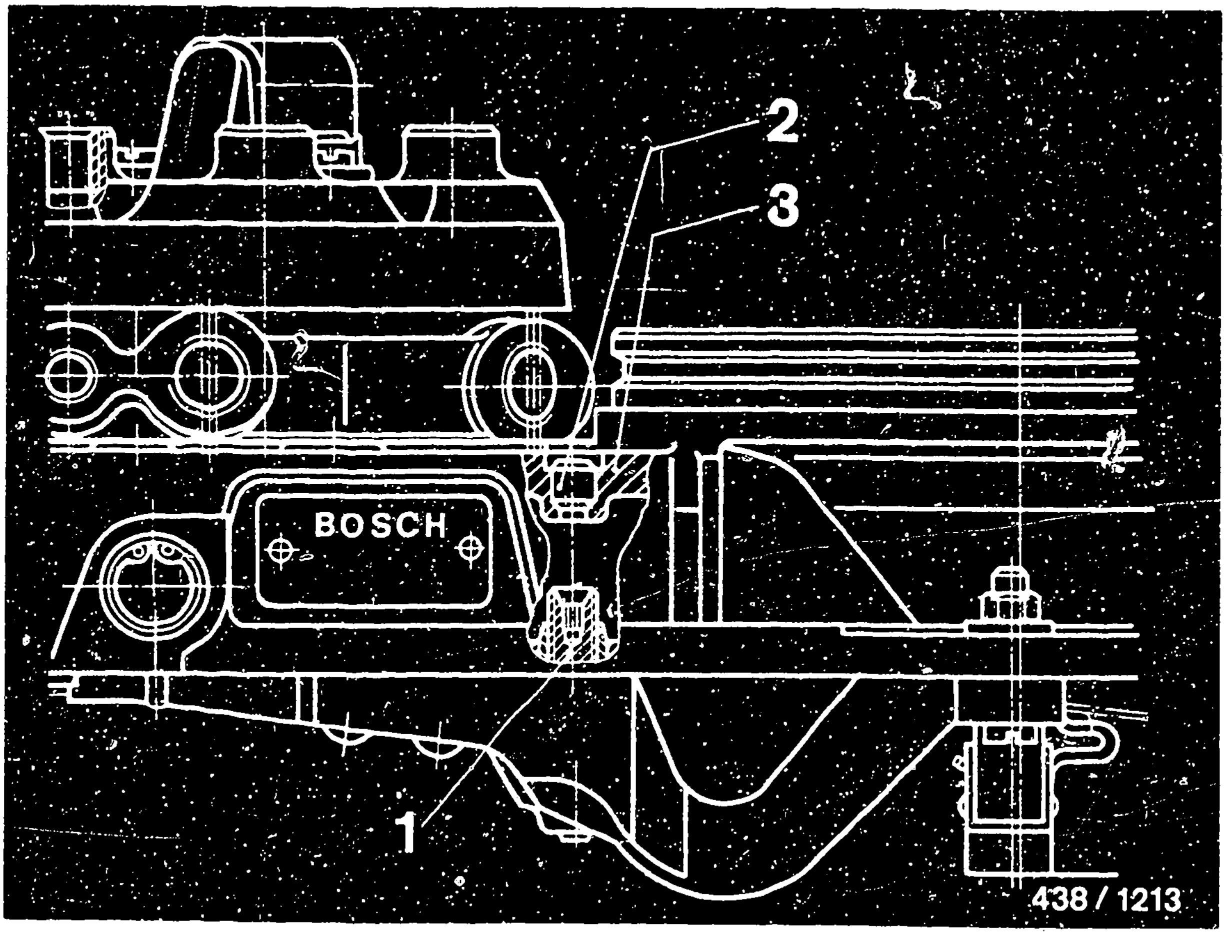


1 = To the idle mixture screw
2 = Idle speed bypass screw

19.3 Idle speed and CO correction

The idle speed setting device current is set indirectly at the bypass screw on the throttle valve assembly.

The amount of CO in the exhaust gas is adjusted at the idle mixture screw in the mixture control unit.



1 = Idle mixture screw
2 = Aluminum plug
3 = Air flow sensor

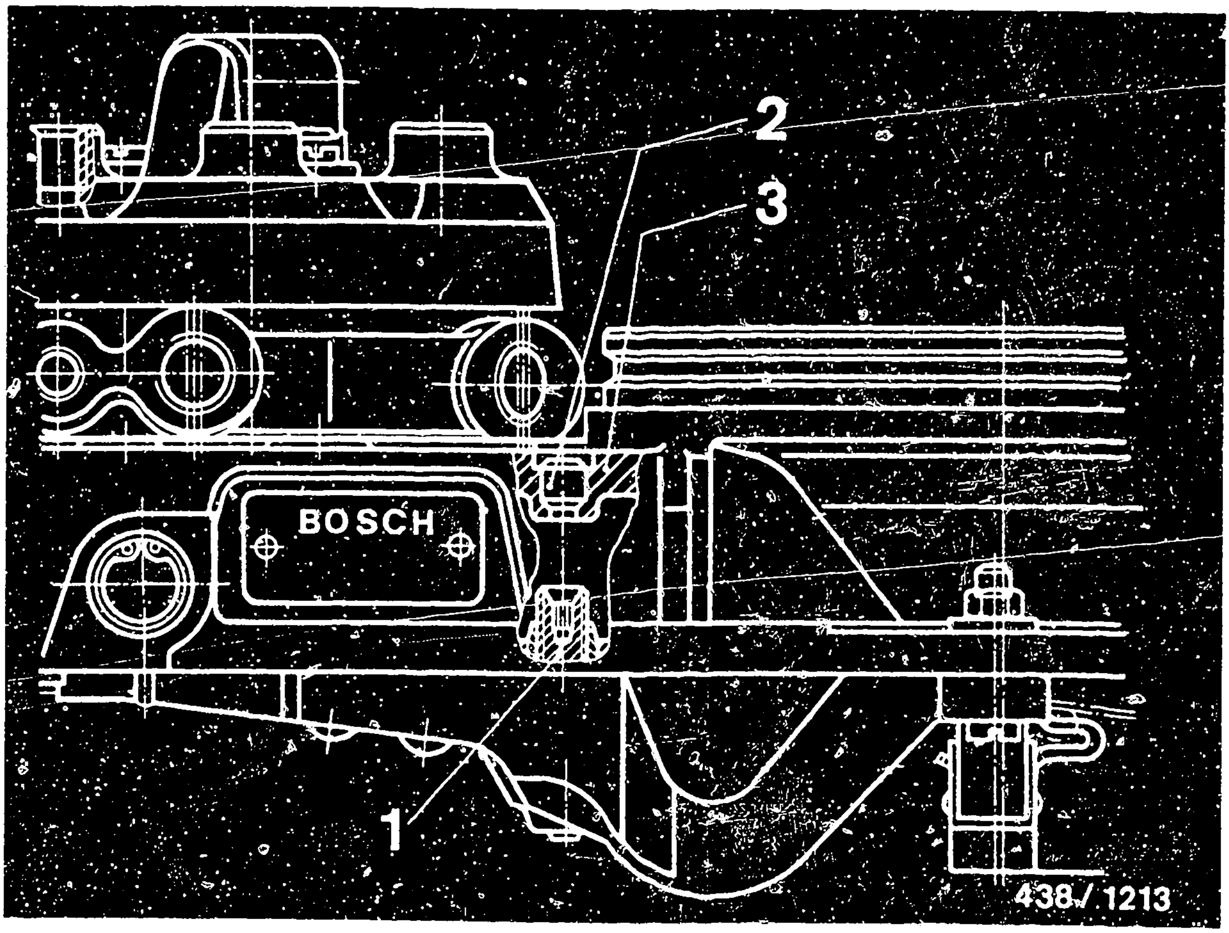
- Aluminum plug, tamper guard

The hole in the air flow sensor which provides access to the idle mixture screw has a pressed-in aluminum plug to prevent tampering. It can be removed using the same set of tools as required for removal of the ECE seal.

(e.g. No. 4521/7, Hazet Co., 5630 Remscheid, FRG)

A steel tab is inserted at the bottom of the aluminum plug to prevent full penetration by the pilot drill.

The aluminum plug has the following order number: 2 437 001 009.



1 = Idle mixture screw
2 = Aluminum plug
3 = Air flow sensor

● Setting the CO value

The CO value is set by turning the idle mixture screw in the mixture control unit using adjusting wrench KDEP 1035.

The adjusting wrench is inserted into the idle mixture screw after the aluminum plug is removed.

Clockwise rotation:	enriches mixture
Counterclockwise rotation:	leans out mixture

C a u t i o n !

Always approach the correct CO setting from the lean side, i.e. if the setting is too rich, turn the idle mixture screw counterclockwise "too far", then approach the desired setting by turning the screw clockwise.

Always remove the adjusting wrench after each adjustment, and rev the engine briefly to cool the intake passages.

Then wait until the display of the CO tester has stabilized. Never rev the engine with the adjusting wrench inserted because the main lever in the air flow sensor could be bent.

- CO sampling point

To measure the CO value, first remove the cap (arrow) from the sampling tube.

Remove the metal probe from the tube of the tester, and push the tube directly onto the CO sampling tube.

19.4 Idle speed test values

Test requirements

Engine at operating temperature and oil temperature approx. +80°C.
Turn on high-beam headlights and turn off air conditioner.
Disable the overrun fuel cutoff and exhaust gas recirculation systems (if equipped).

Remove the crankcase breather hose from the cylinder head and close off the hose end.

The radiator fan must not run. The otherwise necessary idle adjustment does not apply, because these vehicles are equipped with an electronic idle speed stabilizer (not a Bosch product).
The bypass screw on the throttle valve assembly is set such that the idle speeds and idle speed setting device flow rates listed below are attained with the engine warm.

- Idle speed

Air conditioner off	730...870 min^{-1}
Air conditioner on	830...970 min^{-1}

- Idle speed setting device current

Air conditioner off	410...450 mA
Air conditioner on:	
Manual transmission	470...510 mA
Automatic transmission	480...520 mA

If the idle speed deviates from the above values, check the idle speed stabilizer.
The idle speed stabilizer is described at coordinates J 8.

• CO value 0.3...1.2% by vol.

With repetition rate oscillating	
Test value	25...65%
Setting value	50%

19.5 Concluding work

Reconnect crankcase breather hose to the cylinder head.

Reconnect the manifold pressure line of the overrun fuel cutoff system to the branch.

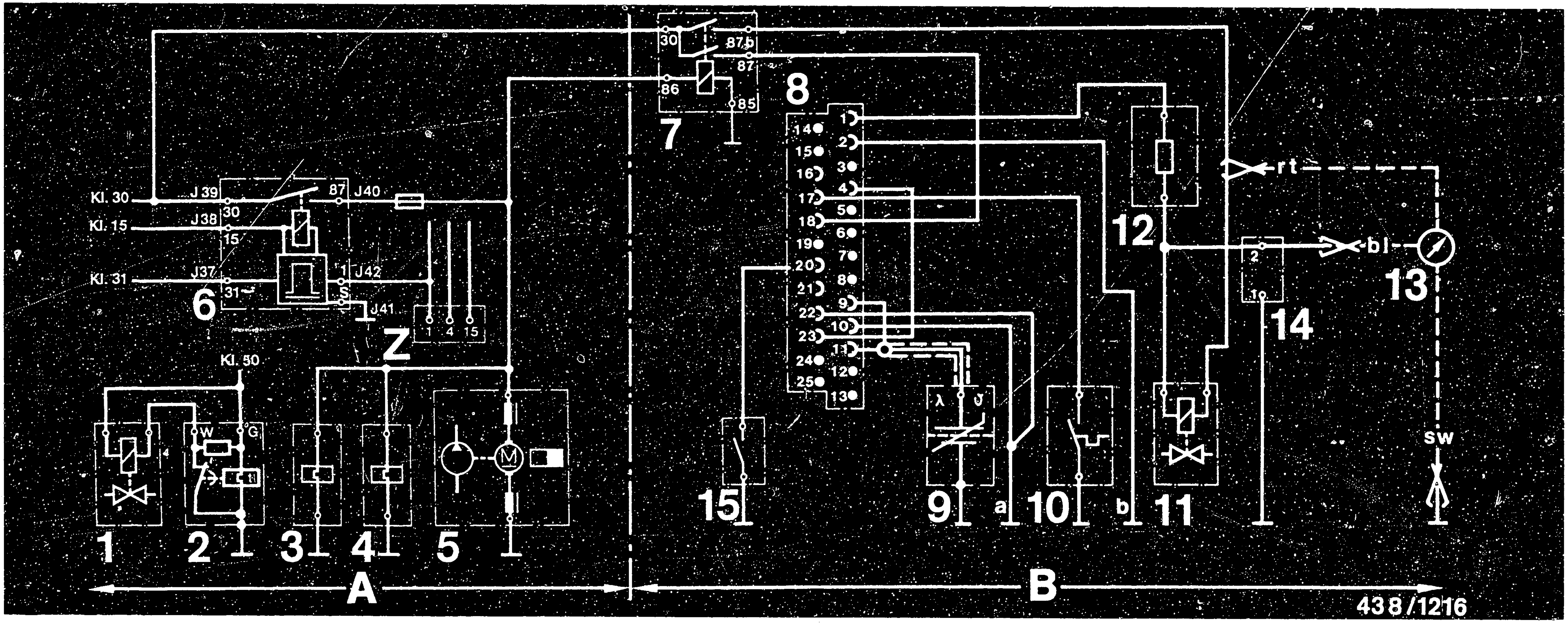
20. Lambda closed-loop control

20.1 General information

The following section concerns only the testing and repair of the lambda closed-loop control, and assumes that the actual K-Jetronic system is operating properly.
Follow the test chart sequence, Section 20.4 (beginning with coordinates G 17).

The lambda closed-loop control in these vehicles incorporates the following functions not described in Technical Instruction VDT-U 3/1 De:

- A thermostatic switch in the cooling system closes when the engine temperature drops below +25°C. At this time the control unit switches to "open-loop control" with a fixed repetition rate (t_3). The mixture is made richer.
- A thermo-valve, open only during the warm-up phase, applies pressure to the pressure jump switch. During acceleration this switch switches the control unit to the fixed repetition rate (t_3) to make the mixture richer.
- The throttle valve switch closes under full load, and switches the control unit to the fixed repetition rate (t_4) to make the mixture richer.
- A dashboard pilot light marked "OXS" reminds the driver to replace the lambda probe.



A = Safety circuit

1 = Cold-start valve
2 = Thermo-time switch
3 = Warm-up regulator
4 = Auxiliary air device
5 = Electric fuel pump
6 = Electronic speed relay
Z = Ignition coil

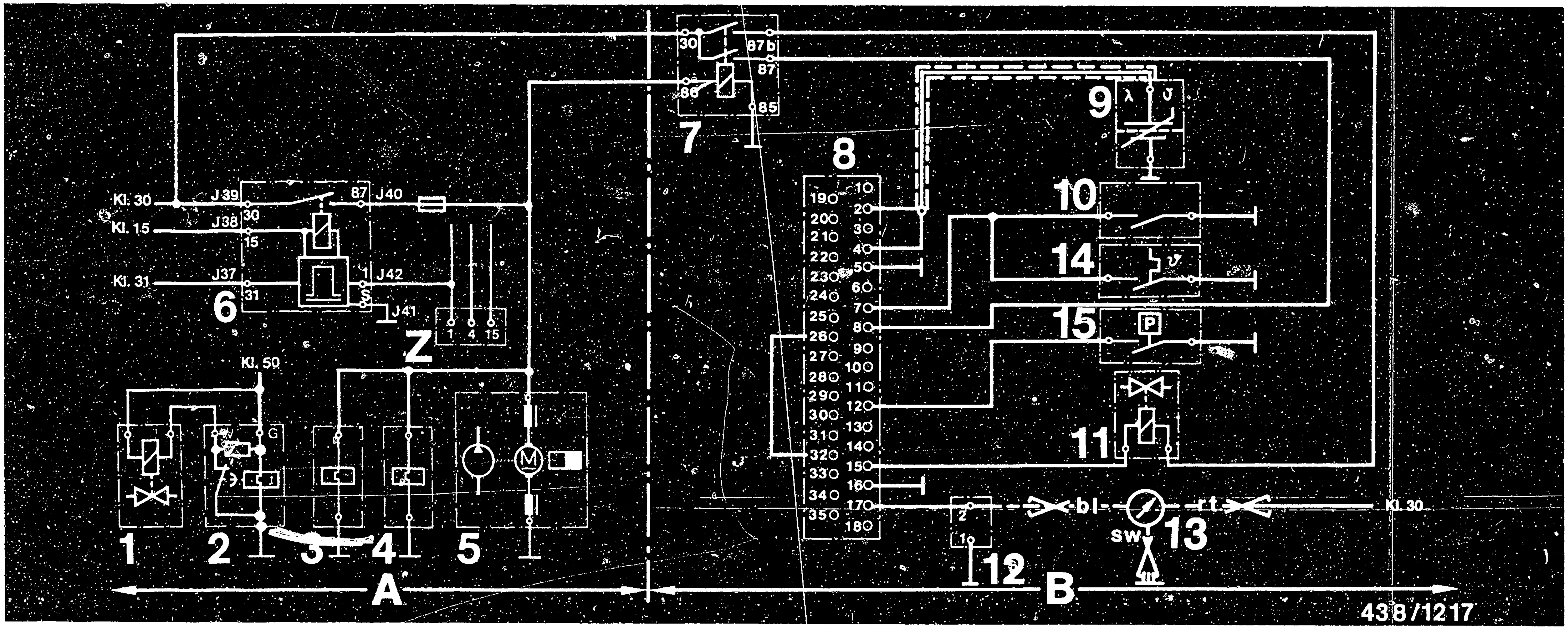
B = Lambda circuit

7 = Main lambda closed-loop control relay
8 = Lambda closed-loop control unit
9 = Lambda probe
10 = Thermostatic switch
11 = Stepping valve
12 = Line resistor

13 = Lambda closed-loop tester KDJE-P 600
14 = Test connection
bl = Blue
rt = Red
sw = Black

a = Ground connection, electronics
b = Ground connection, output stage
15 = Throttle switch

20.2 Electrical safety circuit with lambda closed-loop control, control unit No. 0 280 800 042/043 with 25-pin connector



A = Safety circuit

1 = Cold-start valve
2 = Thermo-time switch
3 = Warm-up regulator
4 = Auxiliary air device
5 = Electric fuel pump
6 = Electronic speed relay
Z = Ignition coil

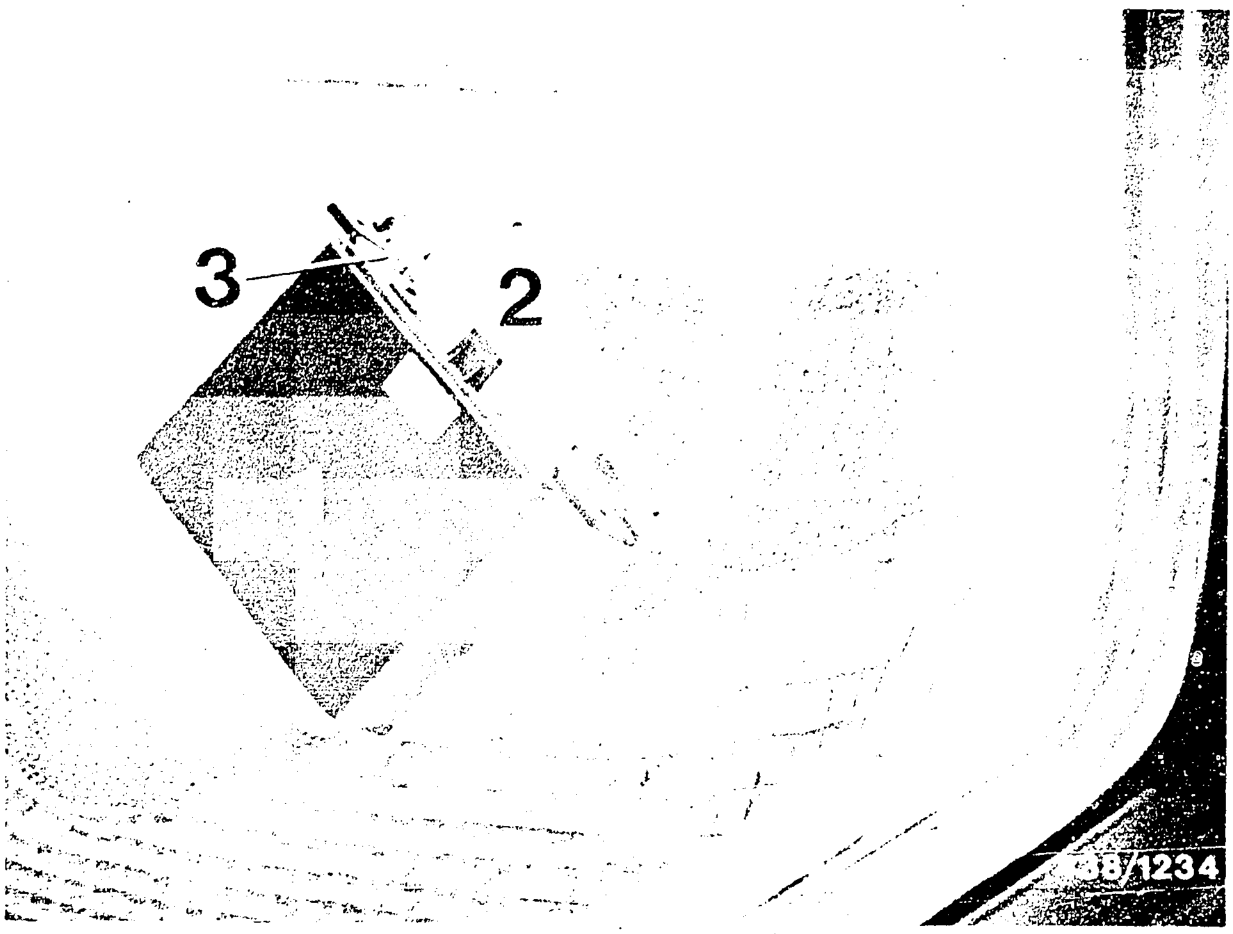
B = Lambda circuit

7 = Main lambda closed-loop control relay
8 = Lambda closed-loop control unit
9 = Lambda probe
10 = Throttle valve
11 = Stepping valve
12 = Test connection
13 = Lambda closed-loop tester KDJE-P 600

14 = Thermo-time switch
15 = Pressure jump switch

bl = Blue
rt = Red
sw = Black

- Electrical safety circuit with lambda closed-loop control, control unit No. 0 280 800 060/061 with 35-pin connector



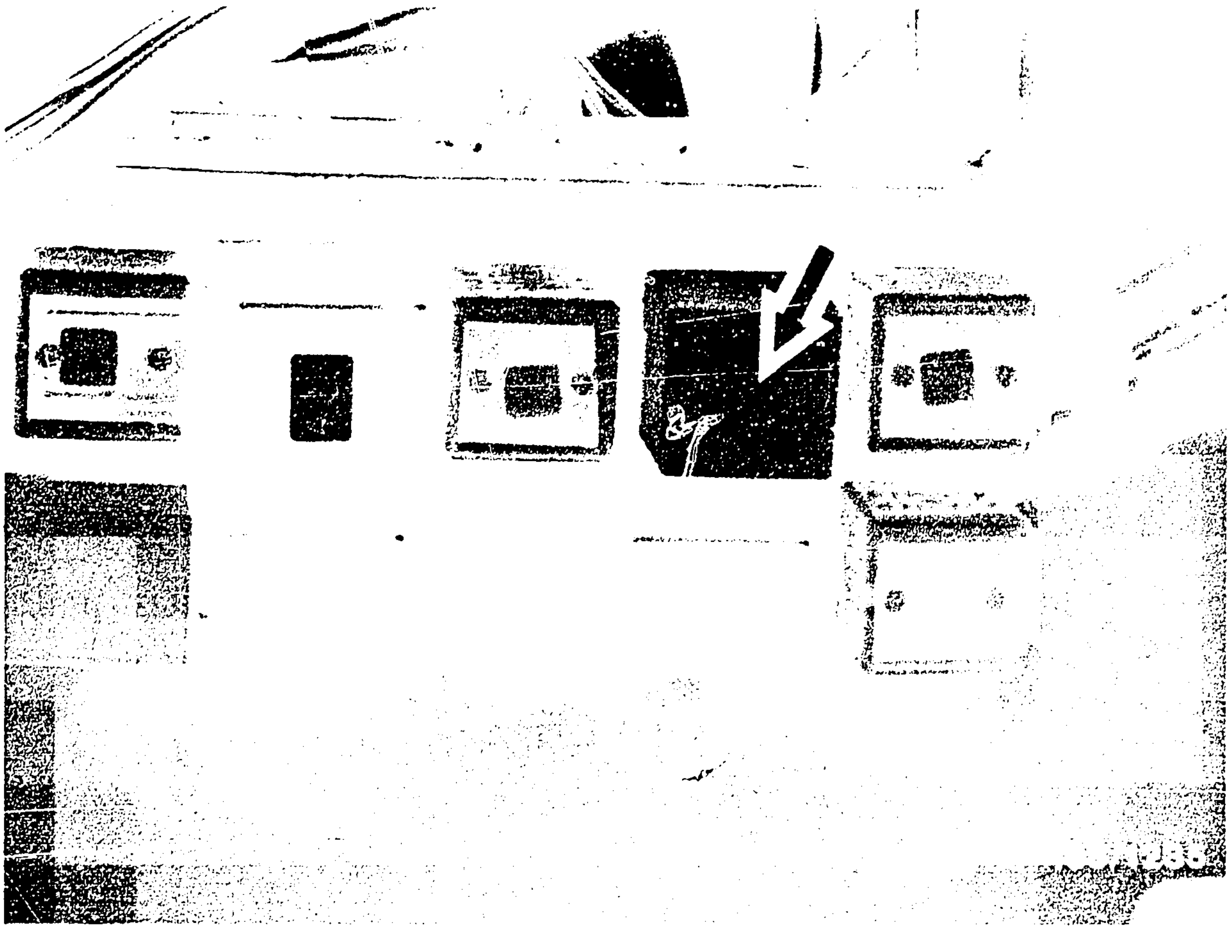
1 = Control unit
2 = Multicontact plug
3 = Detent mechanism

20.3 Individual component locations and additional information:

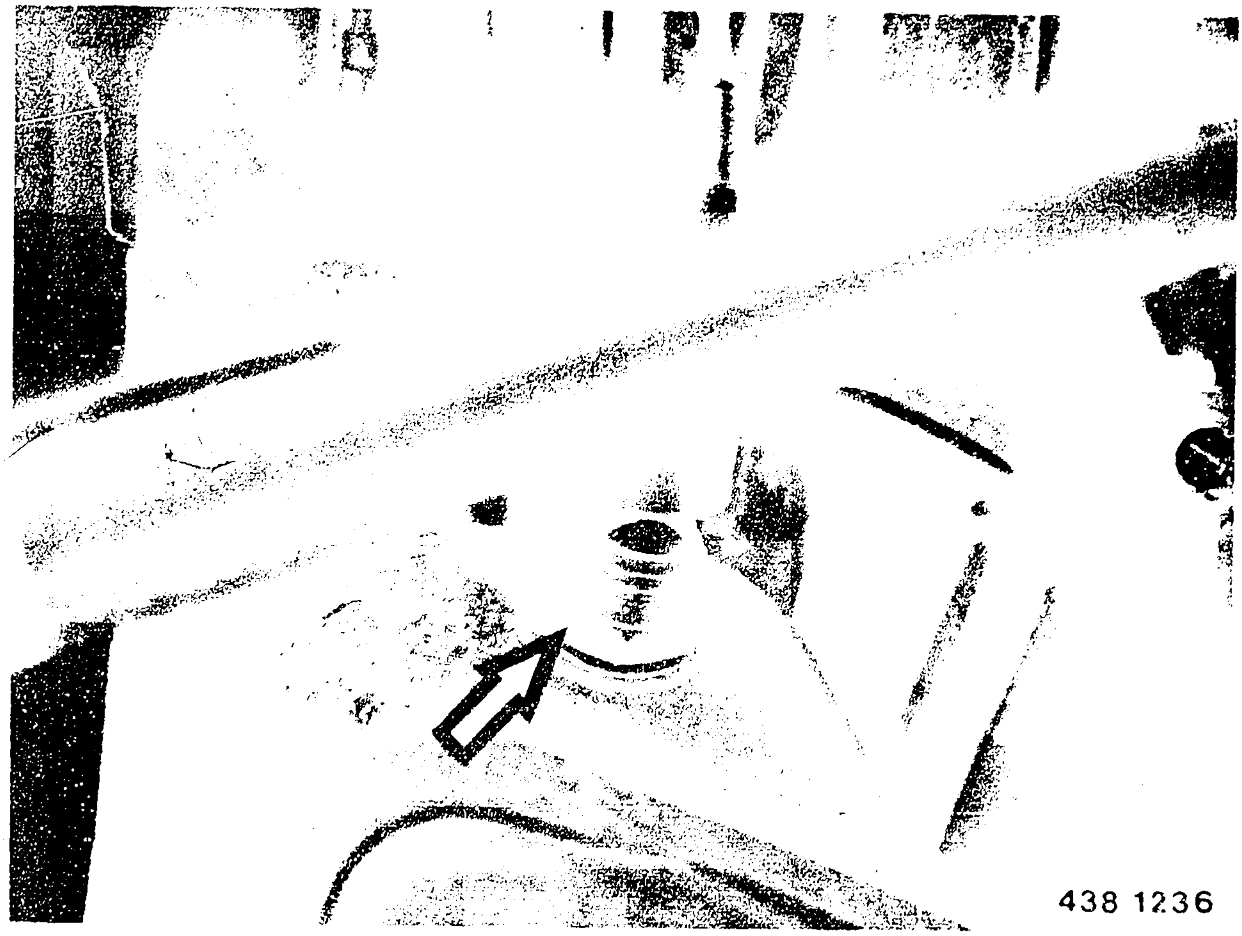
- The 35-pin control unit is located on the right-hand firewall behind the glove box.

- The 25-pin control unit is located in the water box in front of the windshield.

Disconnect the multicontact plug from the control unit: Press the detent mechanism toward the left and tilt the multicontact plug away from the control unit.



- The main lambda closed-loop control relay (arrow) is located at the left below the dashboard.



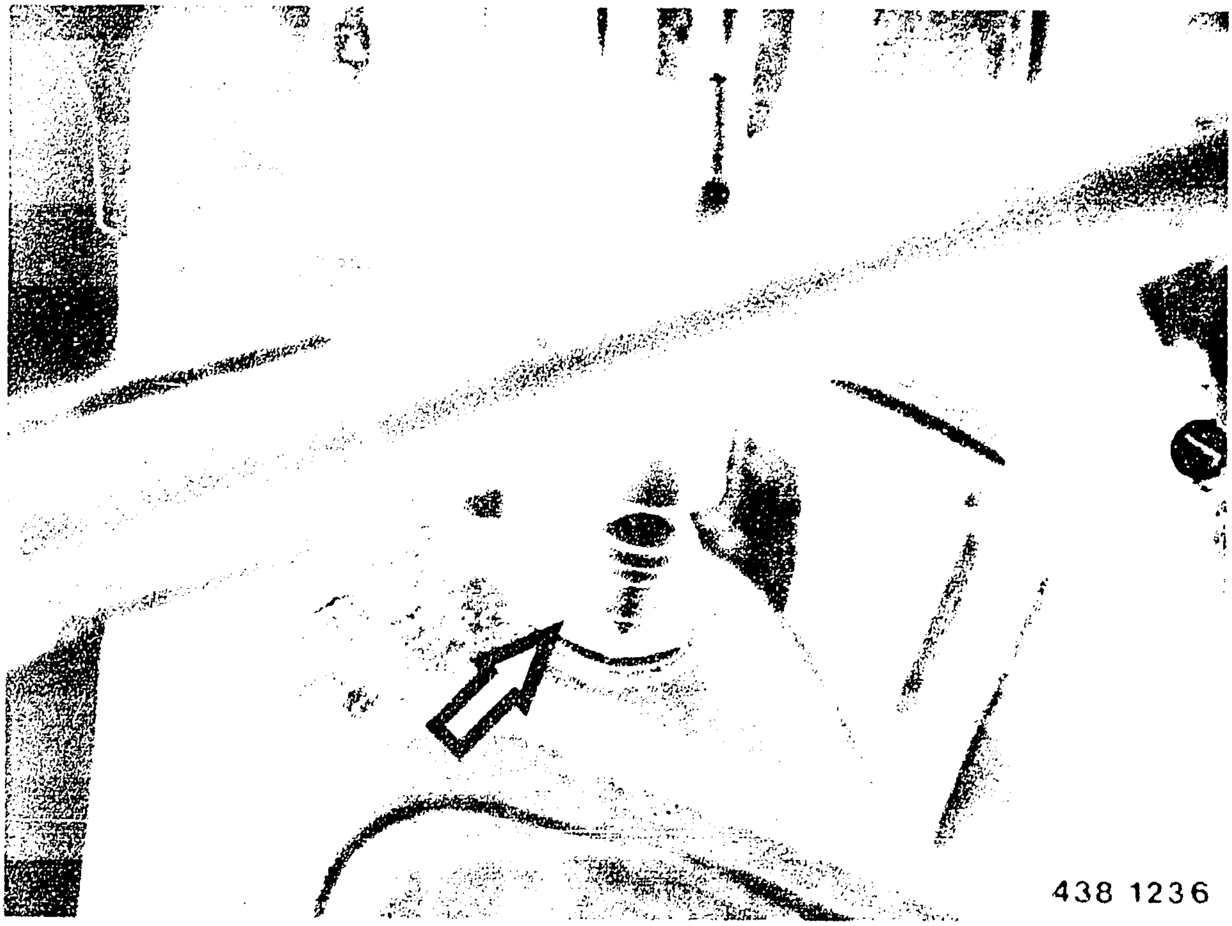
- The lambda probe is screwed into the front of the exhaust pipe (arrow) in the engine compartment.

  In order for the lambda probe to operate properly, the exhaust system must be absolutely leak-tight in the area of the elbow, probe and pipe.

  Leak test:
  Pressurize the exhaust system using compressed air and check for leaks using soapy water or leak detector spray (e.g. Guepoflex) at all fittings and connections.

  Caution:
  Never use combustible fluids to perform leak tests.

  If the probe is replaced, apply special mounting paste VS 14016 Ft (5 964 080 105) to the threads of the new probe. Make sure that paste is applied only to the threads and does not get into the slots in the protective sleeve.



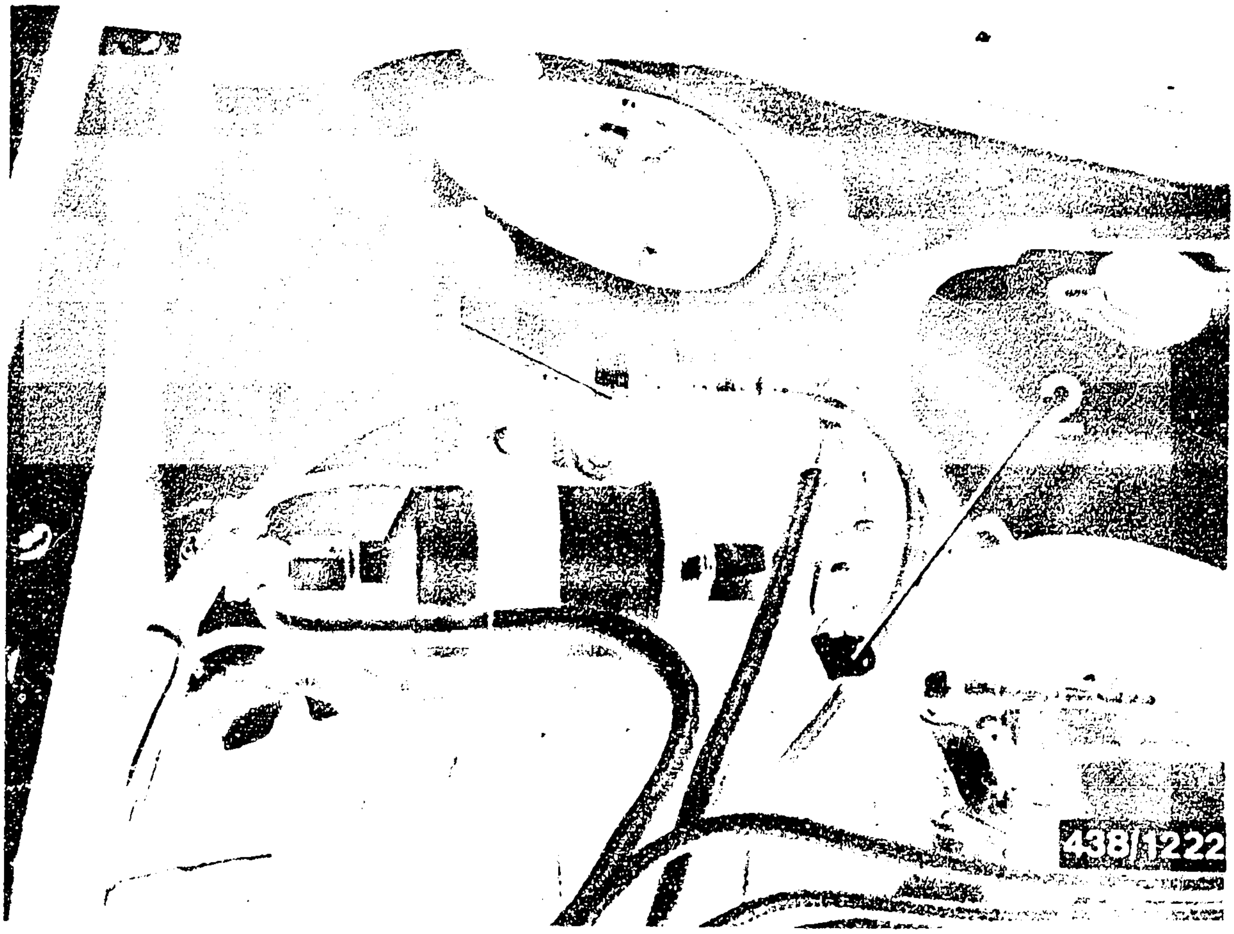
Replacement interval

Replace the lambda probe every 50,000 km (30,000 miles). When this mileage is reached, the dashboard pilot light marked OXS lights.

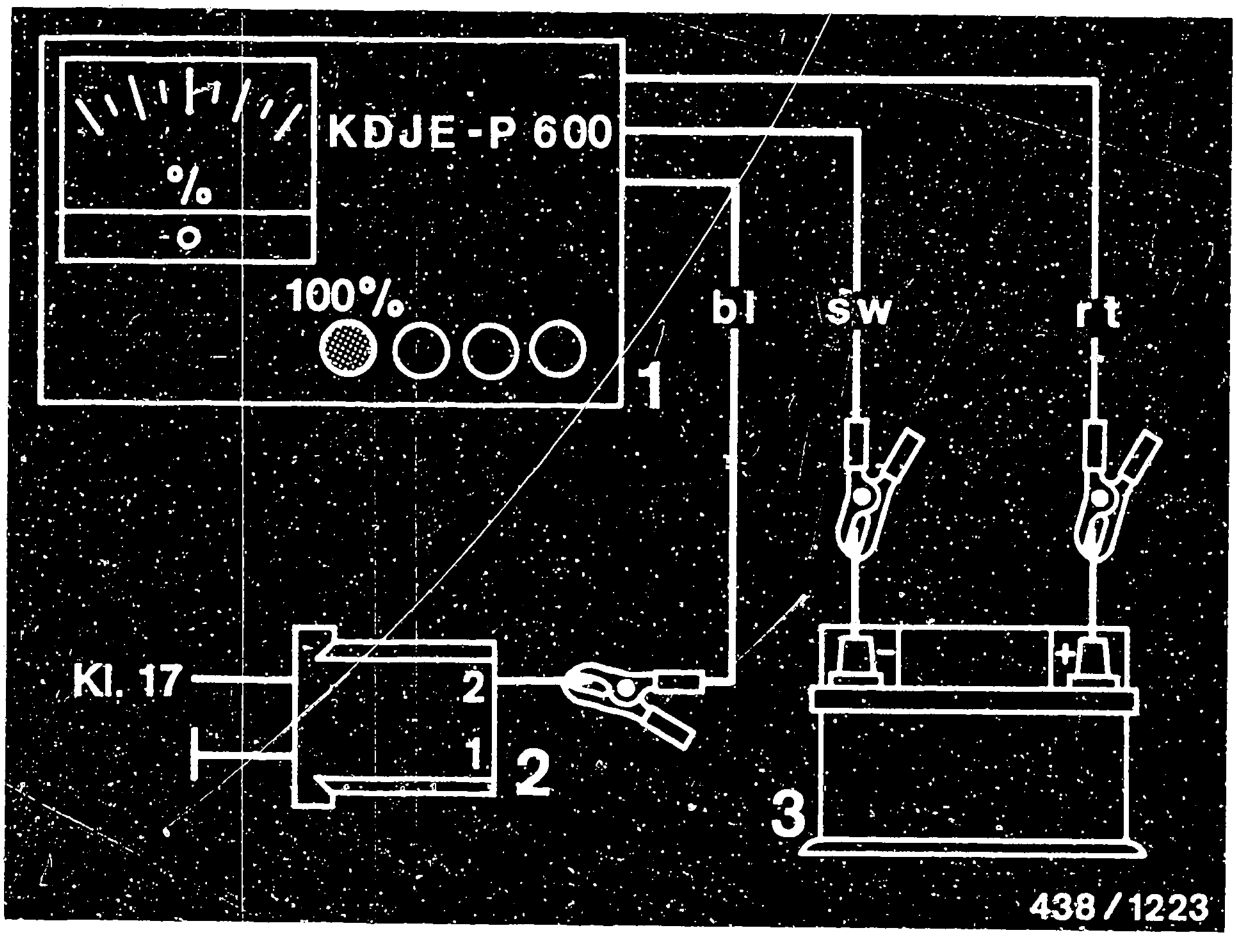
After the lambda probe has been replaced, press the reset button on the odometer located below the dashboard at the left.

- Probe lead connector

Clean the connector (arrow) if necessary before unplugging. When reconnecting, keep dirt out of the connector internals and make sure that the two connector halves snap together.



- 1 = Stepping valve
- 2 = Test connection for lambda closed-loop tester KDJE-P 600

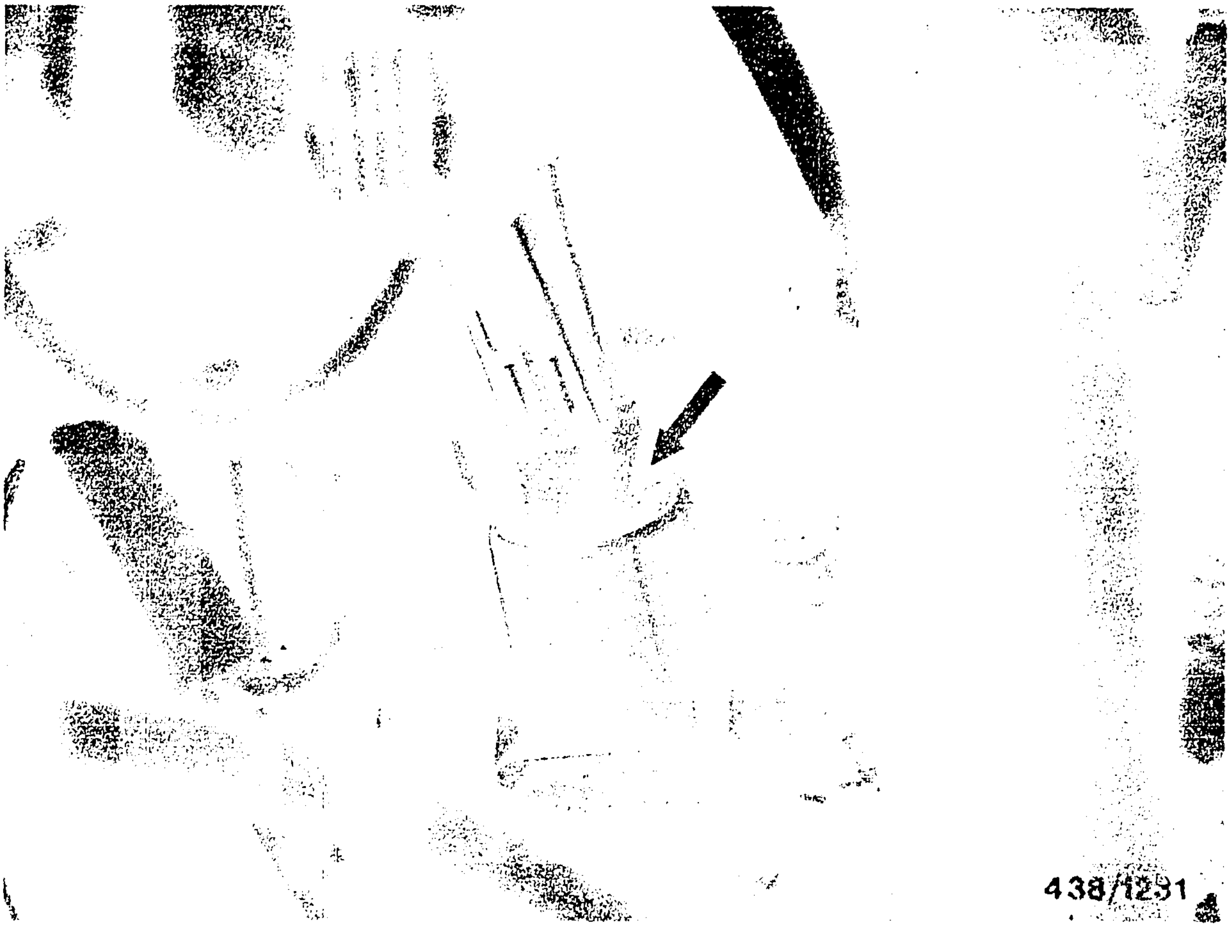


1 = Lambda closed-loop tester
2 = Test connection
3 = Battery
bl = Blue
rt = Red
sw = Black

- Connecting lambda closed-loop tester KDJE-P 600:

The tester is connected using the three-core universal test lead which comes with the tester.
Attach the plus (red) and minus (black) clips directly to the battery.
Attach the blue test clip to contact 2 of the test connection using a wire jumper.

Depress the left-hand pushbutton and read the measurement on the 100% scale.



438/1231

- Thermostatic switch

The thermostatic switch (arrow) is installed in the cooling system.

- Thermo-valve

The thermo-valve is screwed into the engine block.

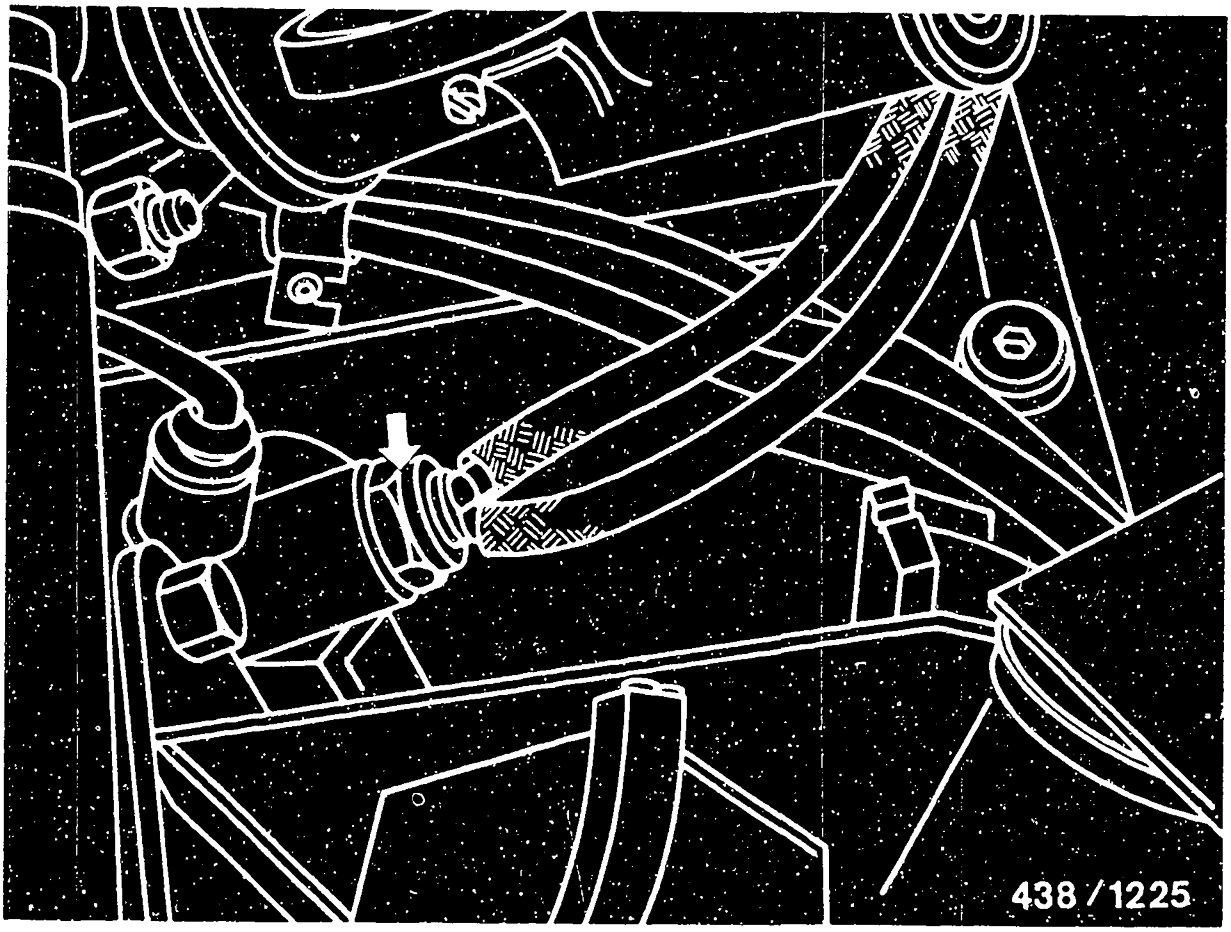
20.4 Test and troubleshooting chart for K-Jetronic lambda closed-loop control

Note:
These procedures can only be carried out if the thermo-time switch (25°C switch) is operating properly.

For this reason, first remove and check the thermostatic switch. Catch any escaping coolant for reuse.

Switching point: 25 ± 5°C.

At temperatures which exceed this value the switch must be open; the switch must be closed at temperatures below this value. (Cool down the switch by placing it in a freezer, or warm it up in a water bath if necessary.)

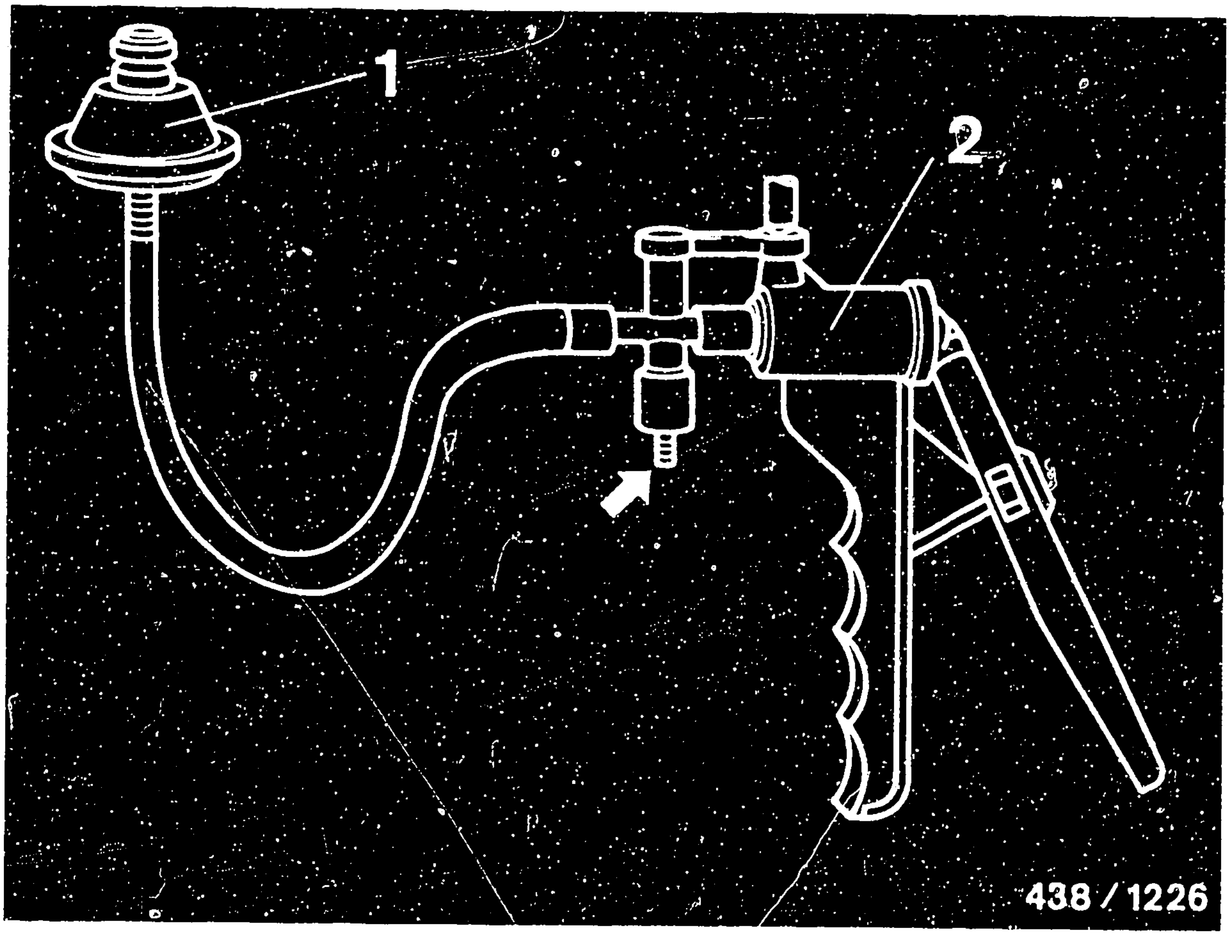


Arrow indicates thermo-valve

- Thermo-valve and pressure jump switch

At temperatures below +50°C the thermo-valve is open and manifold pressure is applied to the pressure jump switch. The pressure jump switch closes briefly during acceleration, and switches the control unit to the repetition rate of 75...85% for acceleration enrichment.
Check the thermo-valve with the engine running.

Test value:	Opening temperature	52...58°C
	Closing temperature	62...68°C
	Open when cold	
	Closed when warm	

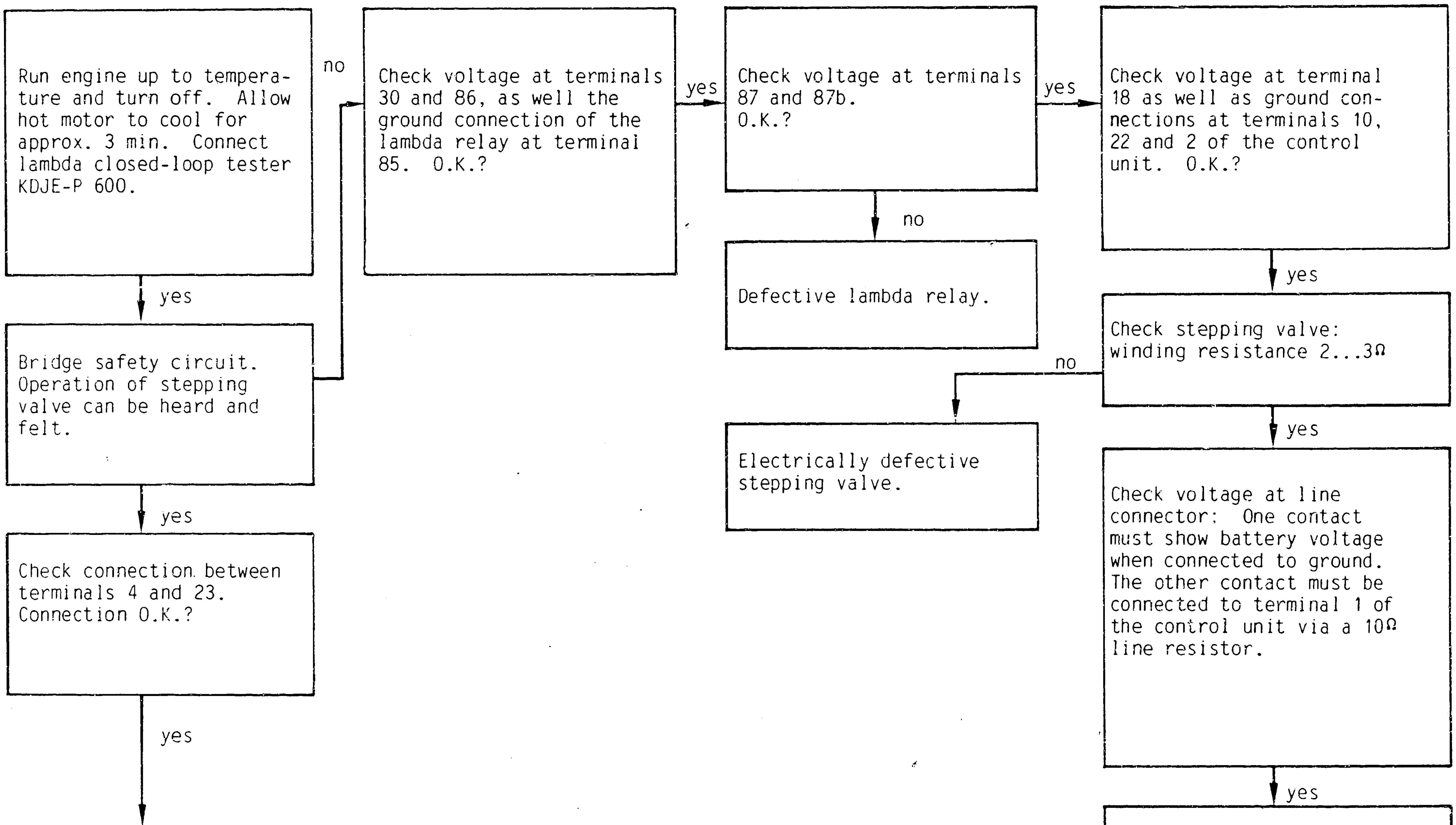


1 = Pressure jump switch
2 = "Mityvac" hand vacuum pump

The pressure jump switch is checked using the "Mityvac" hand vacuum pump and a multimeter set to the ohms scale.
Connect the "Mityvac" hand vacuum pump and the multimeter to the pressure jump switch.
Pump the pressure jump switch down to a vacuum of approx. 600 mbar. The multimeter should indicate ∞ ohms.

When the pressure jump switch (arrow) is vented, the contact closes briefly.
The multimeter should indicate 0 ohms.

• Test and troubleshooting chart for K-Jetronic lambda closed-loop control (USA models)
Control unit 0 280 800 042/043 with 25-pin connector



Continued at G22/G23

● Test and troubleshooting chart for K-Jetronic lambda closed-loop control (USA models)
Control unit 0 280 800 042/043 with 25-pin connector

Continued from G20/G21

Disconnect lead from thermostatic switch. Tester display: repetition rate t_1 (control unit in open-loop mode: wait several seconds before reading static display). t_1 = 45 ... 55%

no

Tester display deviates from 45 ... 55%.

yes

Make sure tester is connected correctly and display indicates %. Repetition rate now O.K.?

no

Disconnect probe lead: Repetition rate goes to 45 ... 55%.

yes

Defective probe

No display.

yes

Check lead from terminal 1 of control unit to test connection for continuity (contact 2 of the test connection).

yes

Disconnect probe lead at plug. Repetition rate remains t_1. Connect probe lead to vehicle ground on control unit side: repetition rate increases to t_2 (control unit switches to "rich mixture stop").

t_2 = at least 87%

no

Check lead from terminal 11 of control unit to probe for continuity. O.K.?

yes

Defective control unit.

yes

Continued at H1/H2

- Test and troubleshooting chart for K-Jetronic lambda closed-loop control (USA models)
Control unit 0 280 800 042/043 with 25-pin connector

Continued from G22/G23

Disconnect probe lead. Connect disconnected thermostatic switch lead to ground.
Repetition rate increases to t_3 (greater than t_1).
t_3 = 75 ... 85%

no → Check lead from terminal 17 of control unit to thermostatic switch; check ground connection.
O.K.?

yes → Defective control unit.

yes ↓

Lead from thermostatic switch remains disconnected.
Connect probe lead to 2 V output of lambda closed-loop tester.
Repetition rate decreases to t_0 (lean mixture stop).
t_0 = max. 20%

no → Defective control unit.

yes ↓

Disconnect probe lead. Move throttle valve to full-load position.
Repetition rate increases to t_4 (greater than t_1).
t_4 = 60 ... 70%

no → Check microswitch on throttle valve assembly and replace if necessary.
Check lead from terminal 20 of control unit to microswitch; check ground connection.
O.K.?

yes → Defective control unit.

yes ↓

Continued at H3/H4

● Test and troubleshooting chart for K-Jetronic lambda closed-loop control (USA models)
Control unit 0 280 800 042/043 with 25-pin connector

Continued from H1/H2

yes

Connect lead to thermostatic switch; probe lead remains disconnected.
Connect exhaust gas tester. Again bring engine up to operating temperature.

yes

Adjust CO value* using idle mixture screw; adjust idle speed at throttle valve assembly.

CO value: 0.3 ... 1.2% by volume

Idle speed:
Air conditioner off: 730...870 min^{-1}
Air conditioner on: 830...970 min^{-1}

yes

Connect probe lead.
CO value now max. 1.0% by volume.

no

Increase speed to approx. 1500 min^{-1}
CO value now 1.0% by volume.

yes

Check for exhaust system leaks (upstream of catalytic converter) or at probe seal, and correct.

no

Disconnect probe lead.
Connect lead to ground on control unit side:
CO value increases.

yes

Defective probe.

no

Hydraulically defective stepping valve.

* To adjust CO value, remove and close off crankcase breather tube on cylinder head. Also remove hose from activated charcoal filter/activated charcoal container.

Test and troubleshooting chart for K-Jetronic lambda closed-loop control (USA models)
Control unit 0 280 800 060/061 with 35-pin connector

Run engine up to temperature and turn off. Allow hot motor to cool for approx. 3 min. Connect lambda closed-loop tester KDJE-P 600.

yes

Bridge safety circuit. Operation of stepping valve can be heard and felt.

yes

Check jumper in multi-contact plug between terminals 26 and 32. O.K.?

yes

Continued at H7/H8

no

Check voltage at terminals 30 and 86, as well the ground connection of the lambda relay at terminal 85. O.K.?

yes

Check voltage at terminals 87 and 87b. O.K.?

no

Defective lambda relay.

yes

Check voltage at terminal 8 as well as ground connections at terminals 5 and 16 of the control unit. O.K.?

yes

Check stepping valve: winding resistance 2...3 Ω

no

Electrically defective stepping valve.

yes

Check voltage at line connector: One contact must show battery voltage when connected to ground. The other contact must be connected to terminal 15 of the control unit.

yes

Defective control unit.

• Test and troubleshooting chart for K-Jetronic lambda closed-loop control (USA models)
Control unit 0 280 800 060/061 with 35-pin connector

Continued from H5/H6

Disconnect lead from thermostatic switch. Tester display: repetition rate t_1. (Control unit in open-loop mode; wait several seconds before reading static display).
t_1 = 45 ... 55%

no

Tester display deviates from 45 ... 55%.

yes

Make sure tester is connected correctly and display indicates %. Repetition rate now O.K.?

no

Disconnect probe lead: Repetition rate goes to 45 ... 55%.

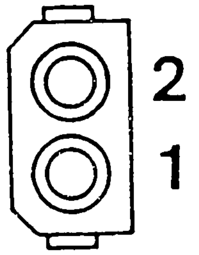
yes

Defective probe

No display.

yes

Check lead from terminal 17 of control unit to test connection for continuity (contact 2 of the test connection).



yes

Disconnect probe lead at plug. Repetition rate remains t_1. Connect probe lead to vehicle ground on control unit side: repetition rate increases to t_2 (control unit switches to "rich mixture stop").
t_2 = at least 87%

no

Check lead from terminal 2 of control unit to probe for continuity. O.K.?

yes

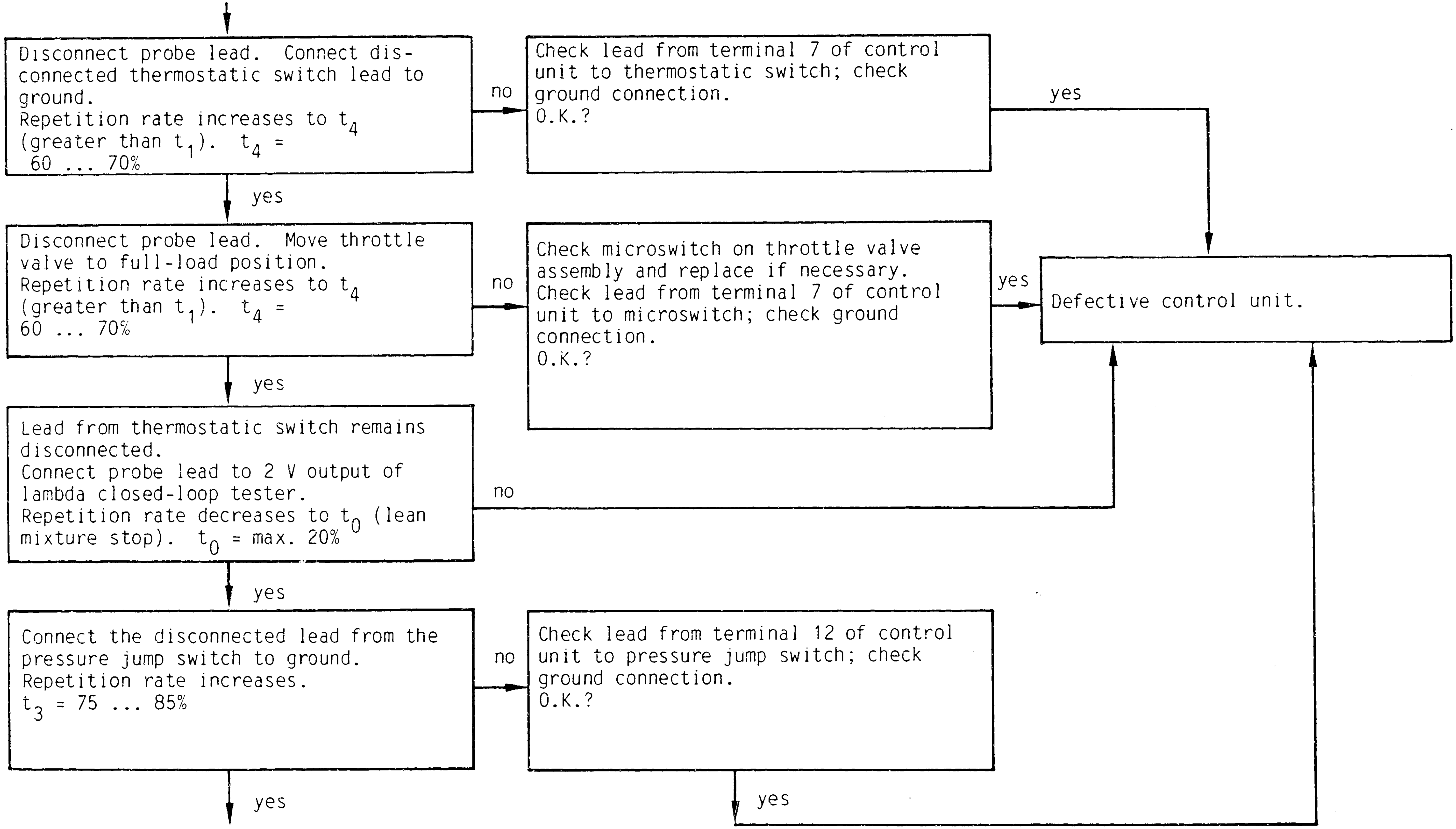
Defective control unit.

yes

Continued at H9/H10

• Test and troubleshooting chart for K-Jetronic lambda closed-loop control (USA models)
Control unit 0 280 800 060/061 with 35-pin connector

Continued from H7/H8



Continued at H11/H12

- Test and troubleshooting chart for K-Jetronic lambda closed-loop control (USA models)
Control unit 0 280 800 060/061 with 35-pin connector

Continued from H9/H10

yes

Connect lead to thermostatic switch; probe lead remains disconnected.
Connect exhaust gas tester. Again bring engine up to operating temperature.

yes

Adjust CO value* using idle mixture screw; adjust idle speed at throttle valve assembly.
CO value: 0.3 ... 1.2% by volume
Idle speed:
Air conditioner off: 730...870 min^{-1}
Air conditioner on: 830...970 min^{-1}

yes

Connect probe lead.
CO value now max. 1.0% by volume.

no

Increase speed to approx. 1500 min^{-1}
CO value now 1.0% by volume.

yes

Check for exhaust system leaks (upstream of catalytic converter) or at probe seal, and correct.

no

Disconnect probe lead.
Connect lead to ground on control unit side:
CO value increases.

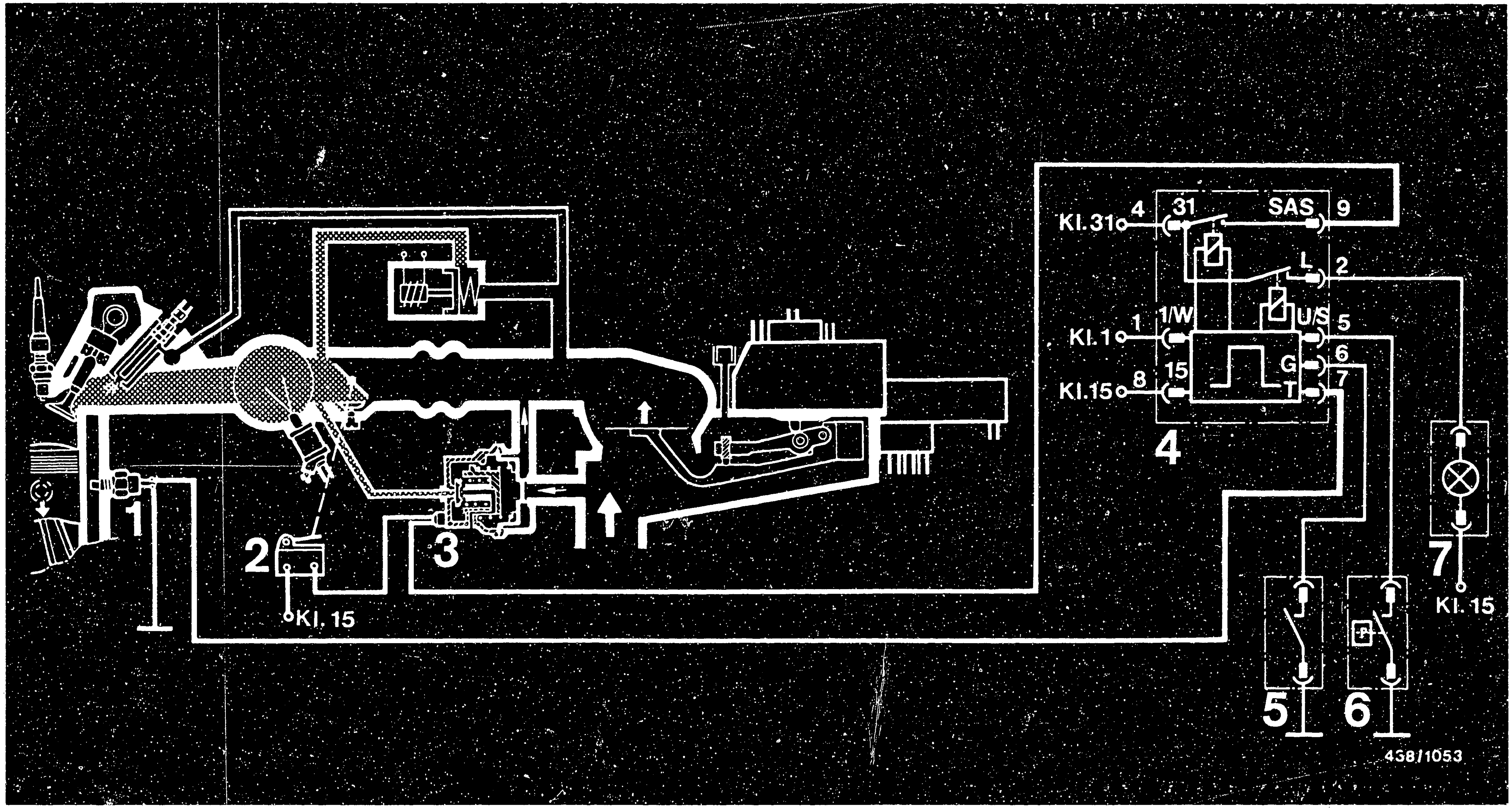
yes

Defective probe.

no

Hydraulically defective stepping valve.

* To adjust CO value, remove and close off crankcase breather tube on cylinder head. Also remove hose from activated charcoal filter/activated charcoal container.



1 = Thermostatic switch
2 = Throttle valve microswitch
3 = Fuel cutoff valve

4 = Control unit for overrun fuel cutoff system and shift indicator
5 = Gearshift

6 = Vacuum switch
7 = Shift indicator lamp

21. Overrun fuel cutoff system

21.1 Operation

The control unit combines the "overrun fuel cutoff" and "shift indicator" systems.

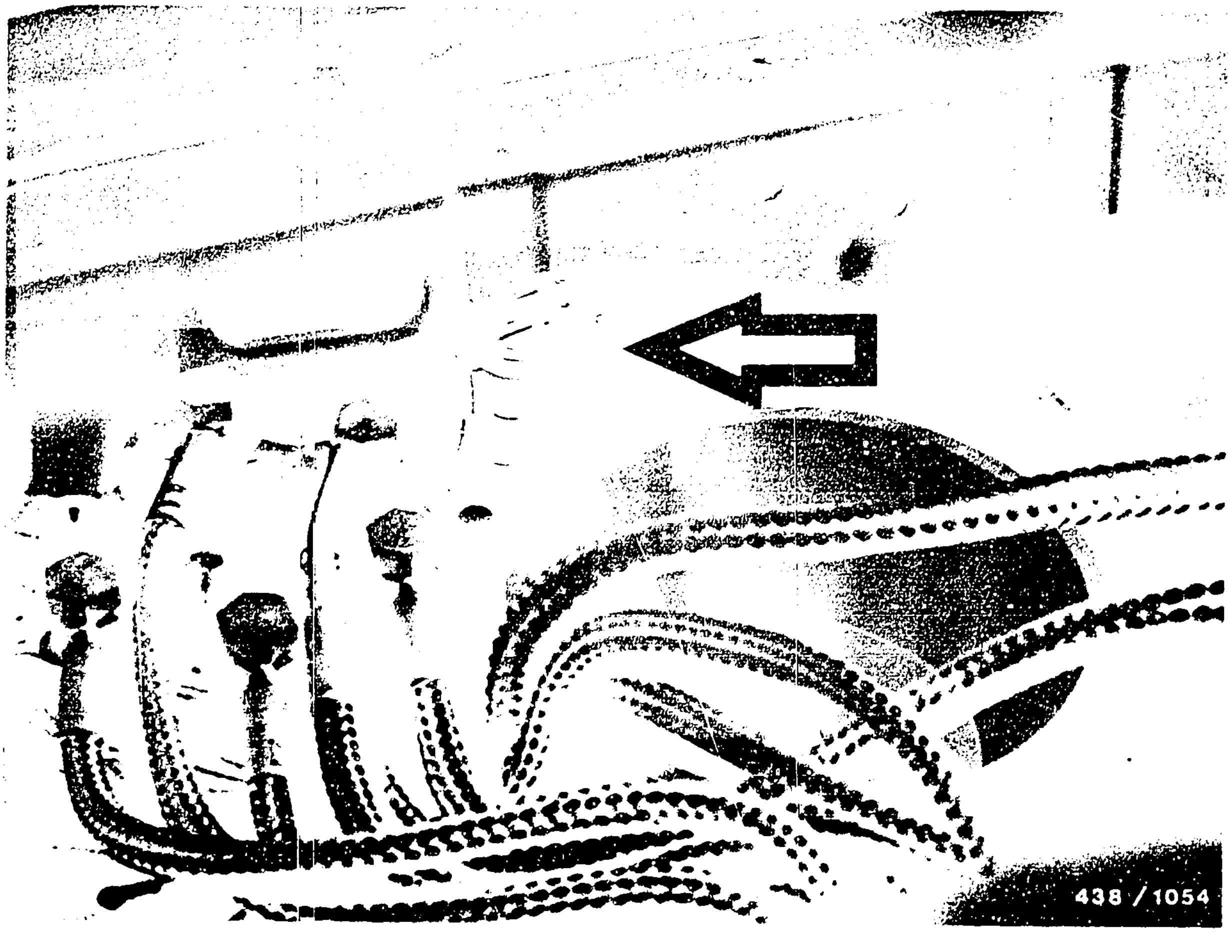
Speed impulses are fed from terminal 1 of the ignition coil to connection 1 of the control unit.
The thermostatic switch, which acts at connection 7, overrides the overrun fuel cutoff system at coolant temperatures below +30°C.

If the engine speed is higher than 1200 min^{-1} and the coolant temperature is greater than +30°C, the fuel cutoff valve is grounded via connection 9 of the control unit.
With the throttle valve microswitch closed (idle position), battery voltage is applied to the fuel cutoff valve.

The control valve in the fuel cutoff valve opens electromagnetically when it receives battery voltage (plus) and is grounded (minus).
The manifold vacuum acts on the spring-loaded diaphragm and opens the air bypass channel.

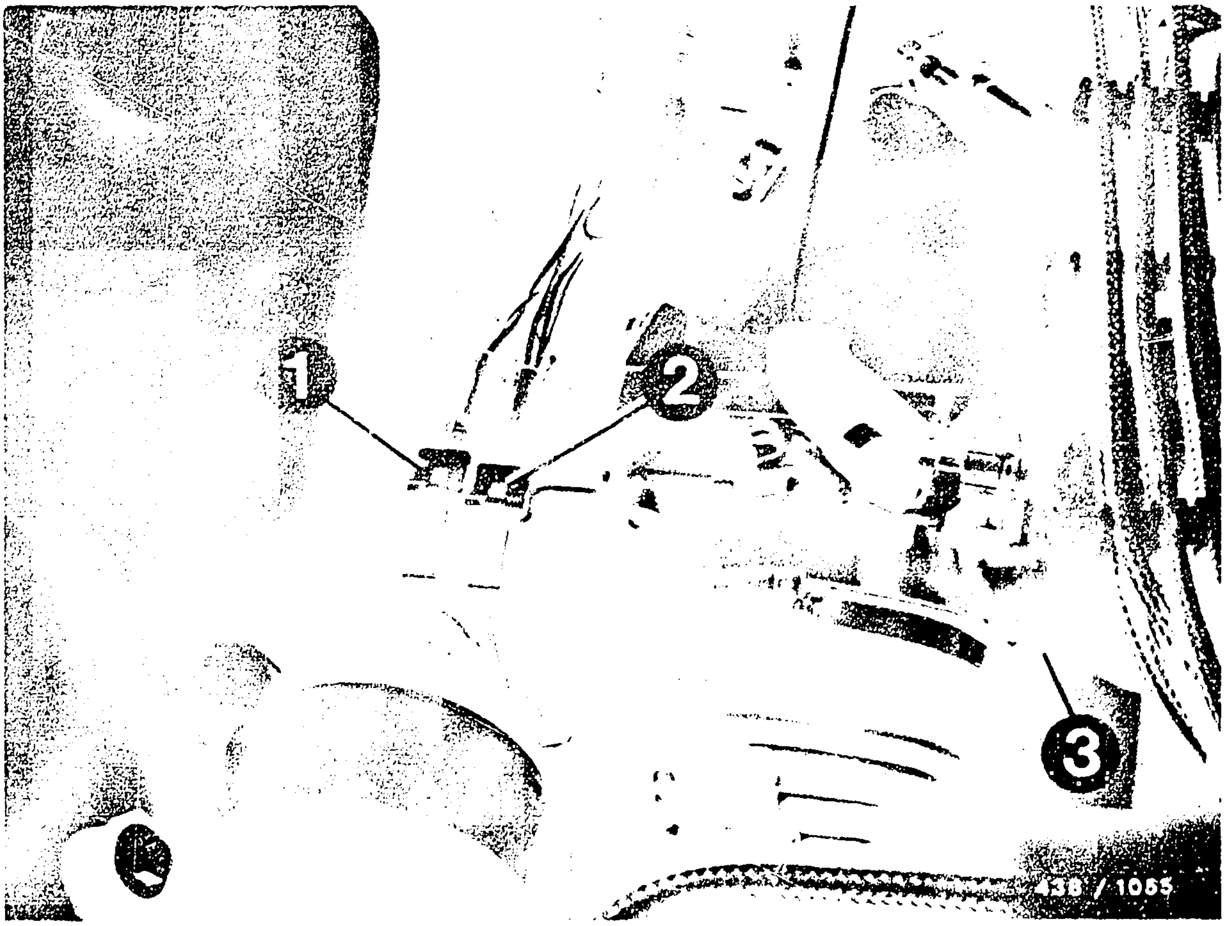
With the fuel cutoff valve open, the air aspirated by the engine bypasses the air flow sensor. The sensor plate remains in its rest position, and no fuel is metered or injected.

When one of these conditions changes, the fuel cutoff valve closes and normal fuel metering continues.



Arrow indicates fuel cutoff valve (behind the right-hand side wall).

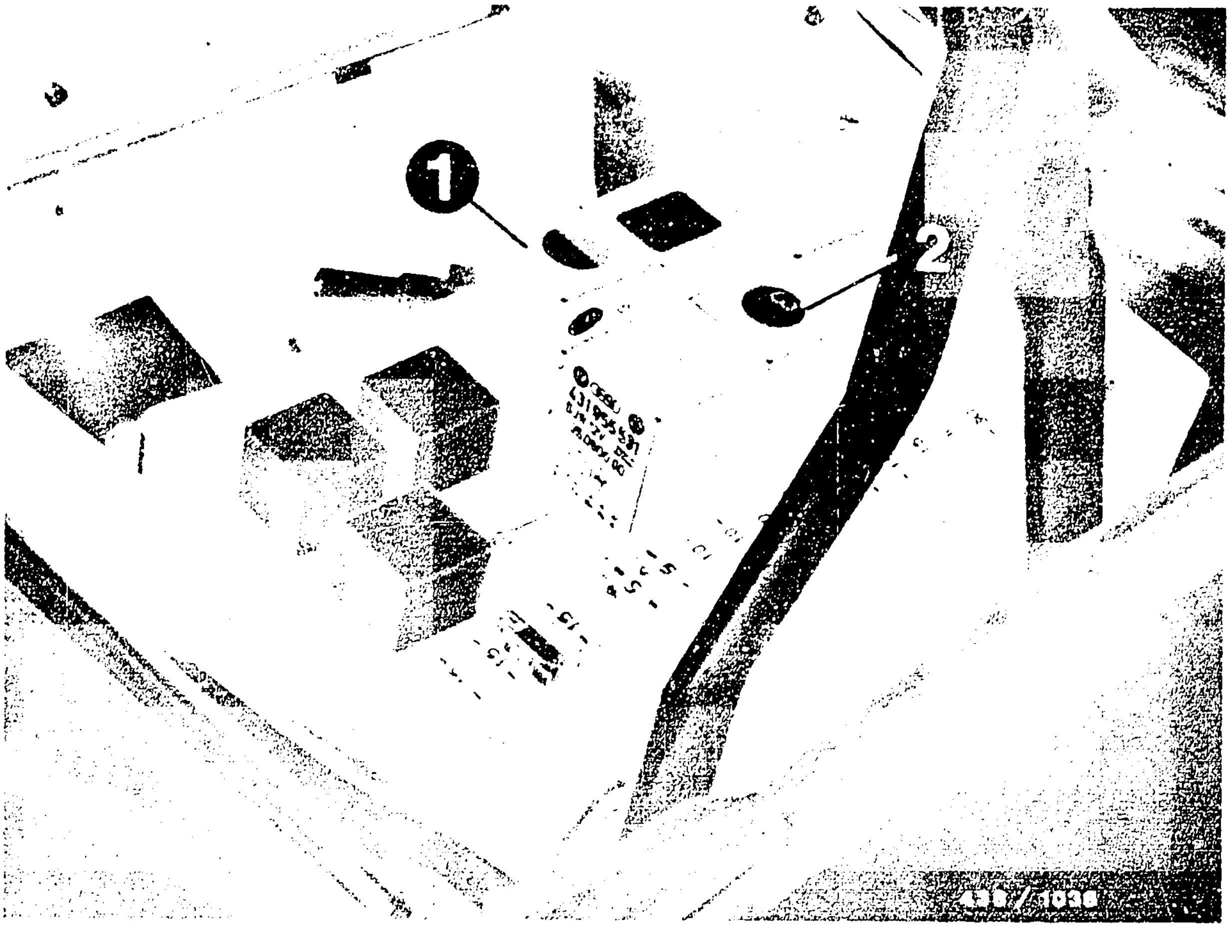
21.2 Component locations



1 = Fuel cutoff valve connector

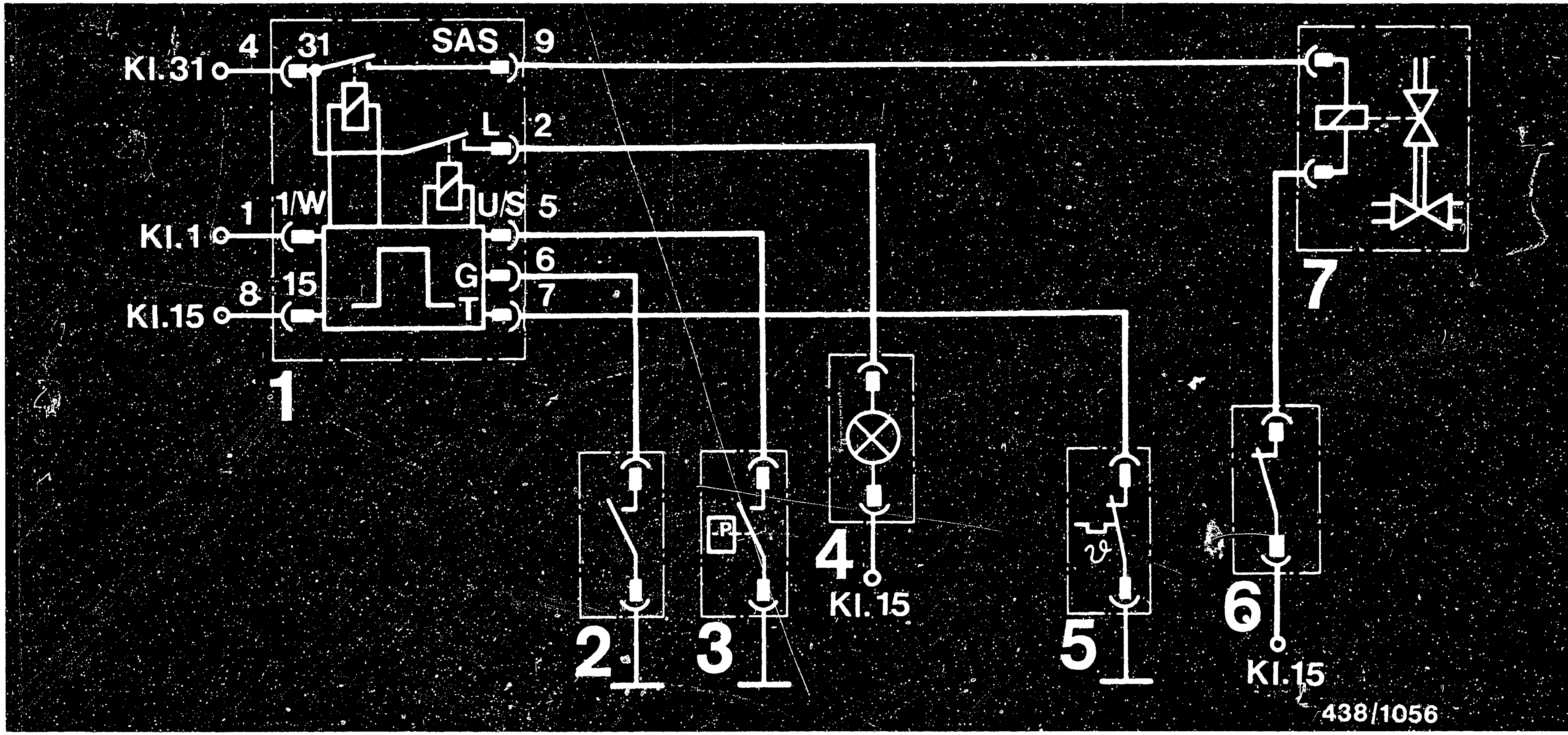
2 = Throttle valve microswitch connector

3 = Microswitch (hidden beneath the throttle valve)



1 = Control unit for overrun fuel cutoff and shift indicator systems

2 = Electronic relay of safety circuit



Overrun fuel cutoff system components

1 = Control unit
5 = Thermostatic switch
6 = Throttle valve microswitch
7 = Fuel cutoff valve

Shift indicator components

1 = Control unit
2 = Gearshift
3 = Vacuum switch
4 = Shift indicator lamp

21.3 Electrical-circuit diagram

The thermostatic switch and the throttle valve microswitch are also used for idle speed stabilization as well with the overrun fuel cutoff system.

21.4 Quick check list for overrun fuel cutoff system

Customer complaint (symptom)

1. Strong acceleration jolt with high load change out of overrun phase
2. Engine speed drops or engine quits when declutching during the overrun phase
3. Overrun fuel cutoff system functions even with engine cold (temperatures +20°C)

1.	2.	3.	Fault	Remedy	Coordinates
●			Microswitch set incorrectly	Adjust microswitch such that it is closed with the throttle valve in idle position, and opens with a throttle valve deflection of 1...2.5°.	J 1
●			Bad throttle valve bearing	Check play in throttle valve stop and bearing. Adjust stop or replace bearing if necessary.	----
	●		Fuel cutoff valve does not close or leaks	Replace fuel cutoff valve	J 2 / J 3
	●		Defective control unit	"On" and "off" speed thresholds of control unit are incorrect. Control unit is defective or wrong part number -- replace.	----
		●	Thermostatic switch does not open or is defective	Replace thermostatic switch	C 7 / C 11

21.5 Electrical checks

Check all leads for continuity and proper connection.

- Control unit

Check socket connections with control unplugged.

Inputs:

Connection 15 = Battery voltage (plus) from terminal 15 (ignition)
Connection 1 = Speed impulses from terminal 1 (ignition coil)
Connection 31 = Ground from throttle valve assembly
Connection T = Ground from thermostatic switch (only at engine temperatures $\leq$ +20°C)

Output:

Output SAS = To one connection of the fuel cutoff valve

Shift indicator connections

Inputs:

Connection U/S = Ground from vacuum switch
Connection G = Ground from gearshift

Output:

Output L = Goes to shift indicator lamp

- Microswitch

Check of coupling connections. Do not unplug the connector behind the throttle valve assembly.

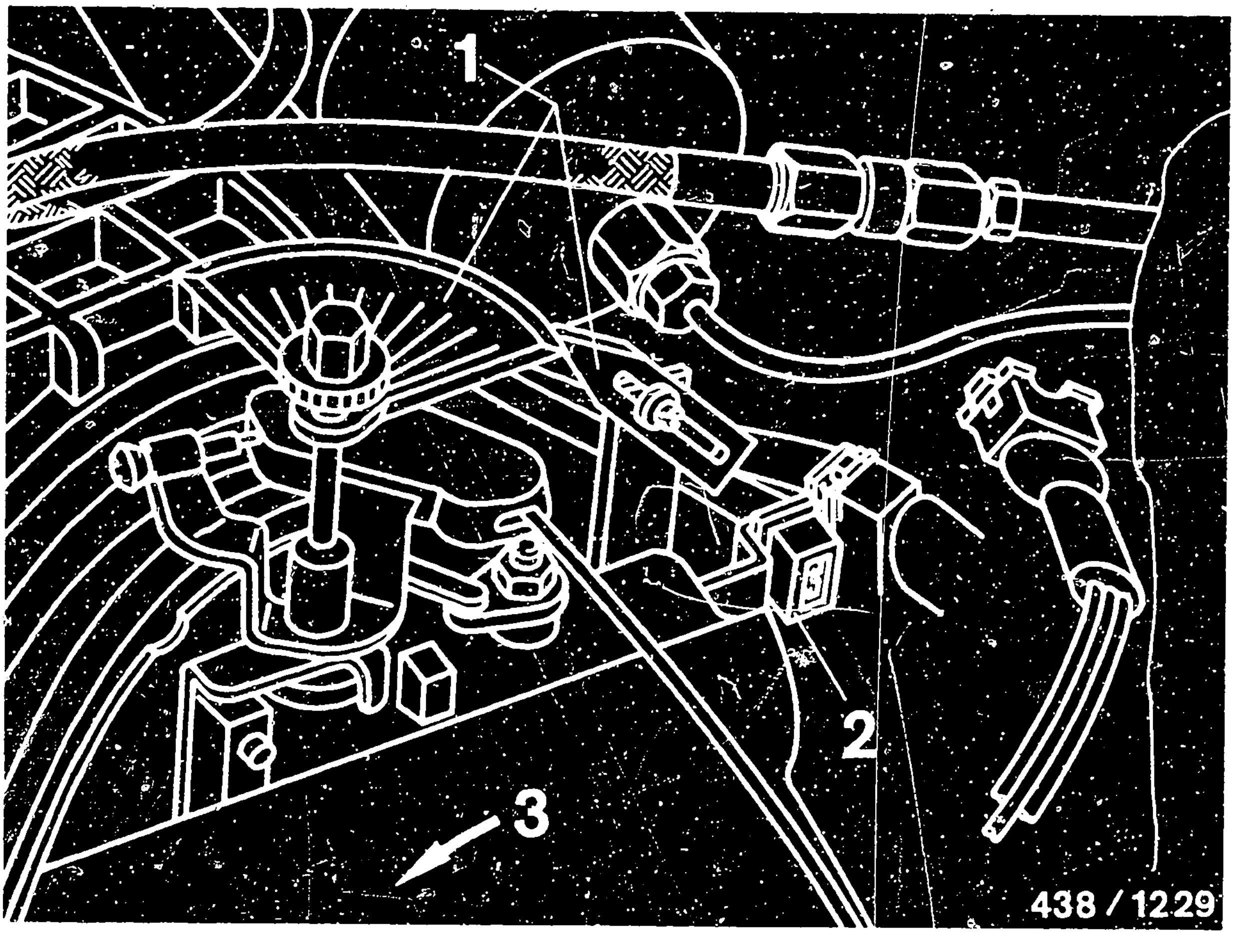
Input : Battery voltage via terminal 15
Output: Battery voltage applied to fuel cutoff valve when throttle valve is in idle position

- Fuel cutoff valve

Check coupling connections. Unplug connector behind throttle valve assembly.

Inputs : One connection goes to the SAS connection of the control unit. The other goes to the microswitch.

Checking connector resistance: Test value: approx. 40 ... 90Ω



1 = Protractor KDJE-7462
2 = Connector for throttle valve microswitch
3 = Microswitch (hidden beneath the throttle valve)

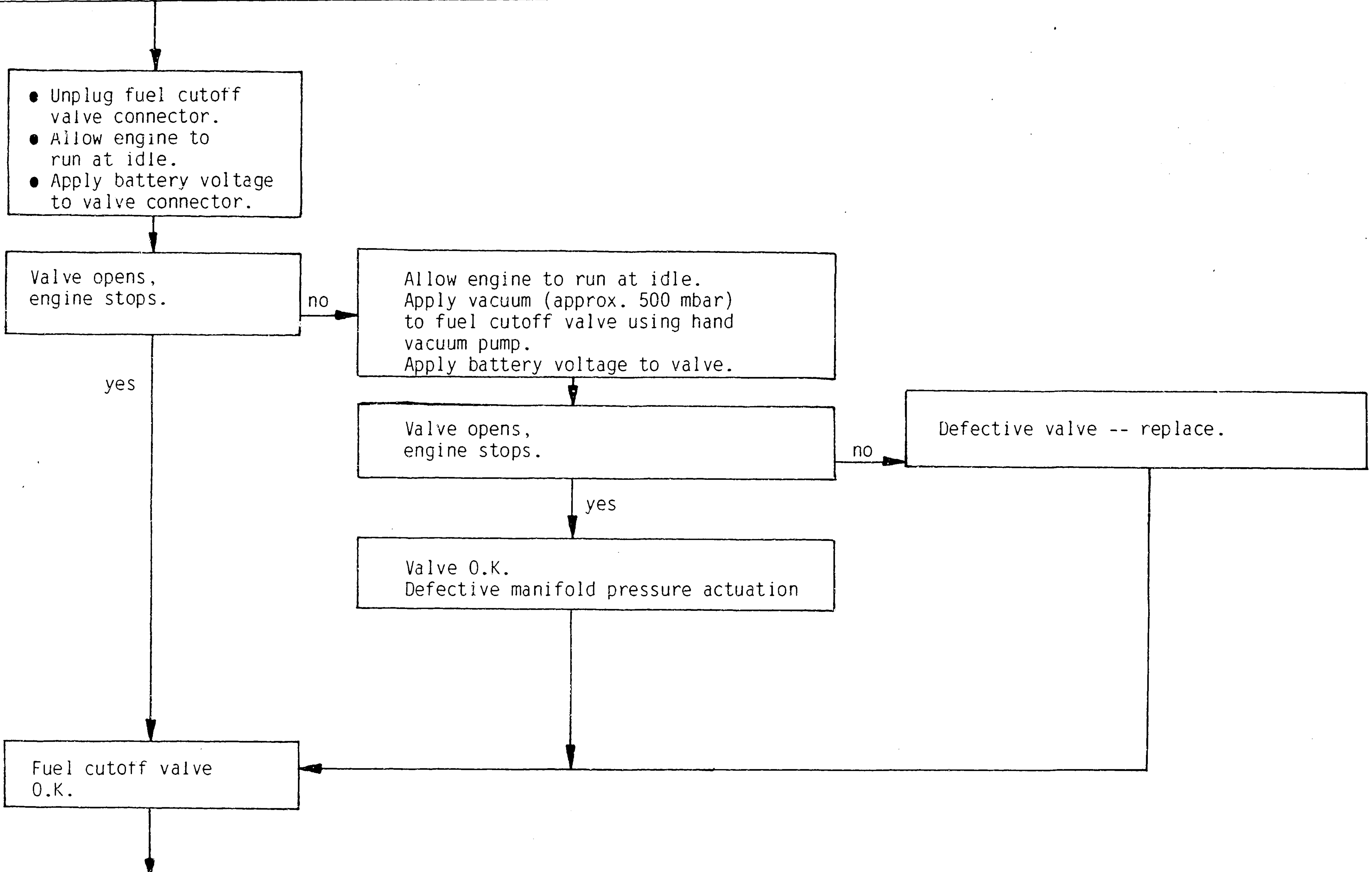
21.6 Adjusting the microswitch

Microswitch adjustment is checked using protractor KDJE-7462 and a multimeter.

The switch contact must be open with the throttle valve in its idle position.

The throttle valve assembly must be removed to adjust or replace the microswitch.

21.7 Checking operation of overrun fuel cutoff system



Continued at J4/J5

Checking operation of overrun fuel cutoff system (continued)

- Unplug control unit from socket.
- Allow engine to run at idle.
- Ground connection SAS.

Valve opens, engine stops.

no → Check microswitch adjustment.

Microswitch is closed with throttle valve in idle position.

no → Adjust microswitch such that it is closed with the throttle valve in idle position, and opens with a throttle valve deflection of 1 ... 2.5°.

yes → Defective microswitch -- replace

yes → Microswitch O.K.

Continued at J6/J7

Checking operation of overrun fuel cutoff system (continued)

- Plug control unit into socket.
- Bring warm engine up to a speed of approx. 3000 min^{-1}.
- Press microswitch.

Valve opens, engine stops.

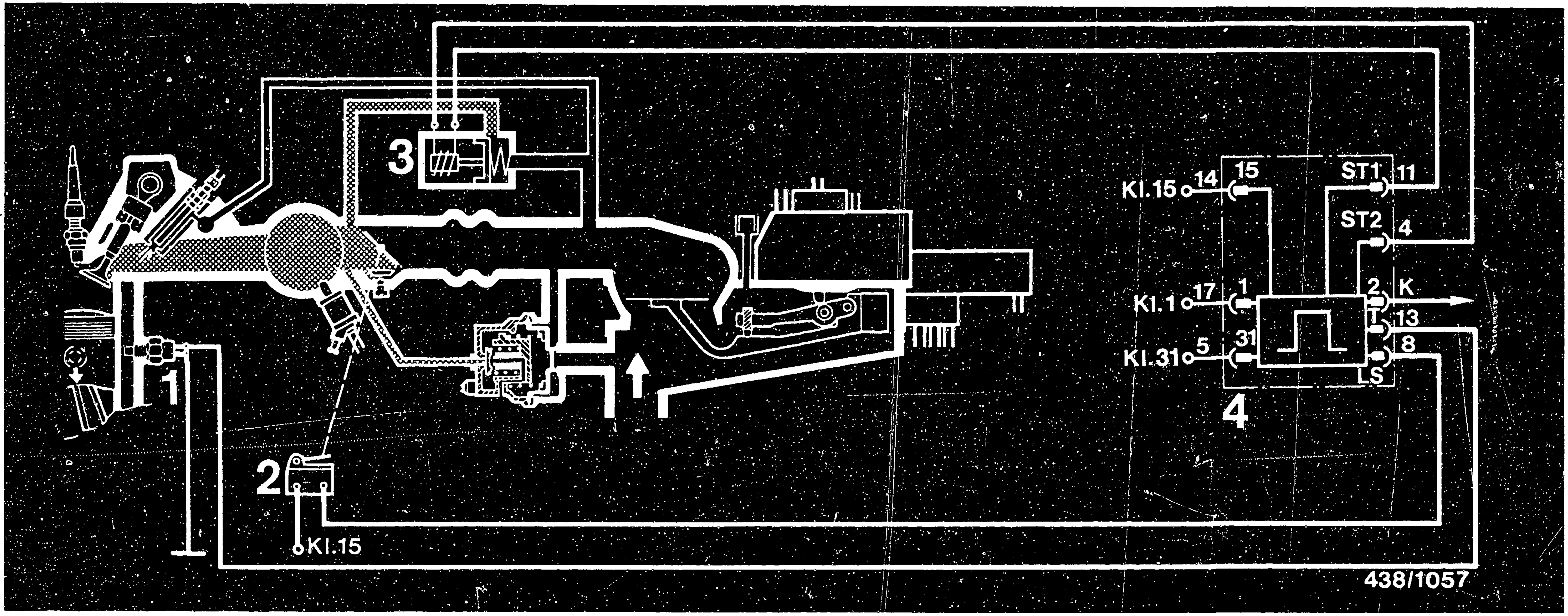
- yes → Control unit and thermostatic switch operate. Overrun fuel cutoff system O.K.
- no → Check thermostatic switch

Thermostatic switch open above 40°C (meter indicates $\infty\Omega$ with connectors unplugged)

- yes → Defective control unit -- replace
- no → Defective thermostatic switch -- replace.

Defective control unit -- replace → Control unit and thermostatic switch operate. Overrun fuel cutoff system O.K.

Defective thermostatic switch -- replace. → Control unit and thermostatic switch operate. Overrun fuel cutoff system O.K.



1 = Thermostatic switch
2 = Throttle valve microswitch

3 = Idle speed setting device
4 = Control unit for idle speed stabilization

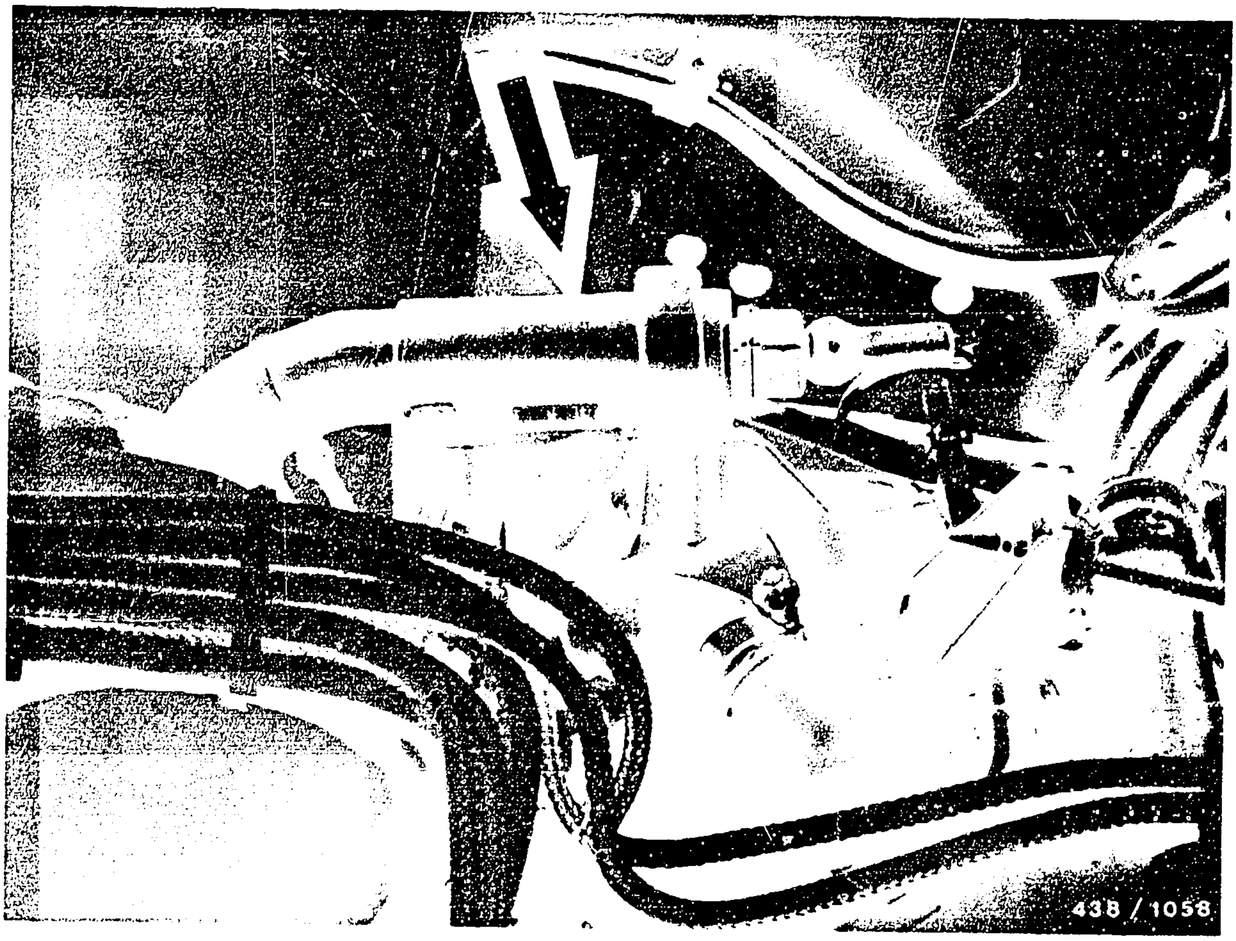
K = To air conditioner compressor

22. Idle speed stabilizer (not a Bosch product)

22.1 Operation

The idle speed is stabilized by the electronic control unit and the idle speed setting device. Instead of the otherwise customary auxiliary air device, the idle speed setting device is used in the air bypass to the throttle valve.

The solenoid of the idle speed setting device receives a variable clocked voltage at a constant frequency from the control unit. This changes the position of the orifice in the air channel and regulates the air throughput.



Arrow indicates idle speed setting device.

The actual engine speed is derived from the ignition impulses (terminal 1), compared with a demand speed in the control unit, and the idle speed setting device makes the corresponding compensation.

The control unit (twice relay size) is located on the relay holder under the dashboard and occupies sockets 11 and 12.

22.2 Components and functions

- Control unit

  Processes input information and drives the idle speed setting device.

- Idle speed setting device

  Regulates air throughput.

- Thermostatic switch +30°C

  Located in the cooling circuit; increases idle speed during the warm-up phase.

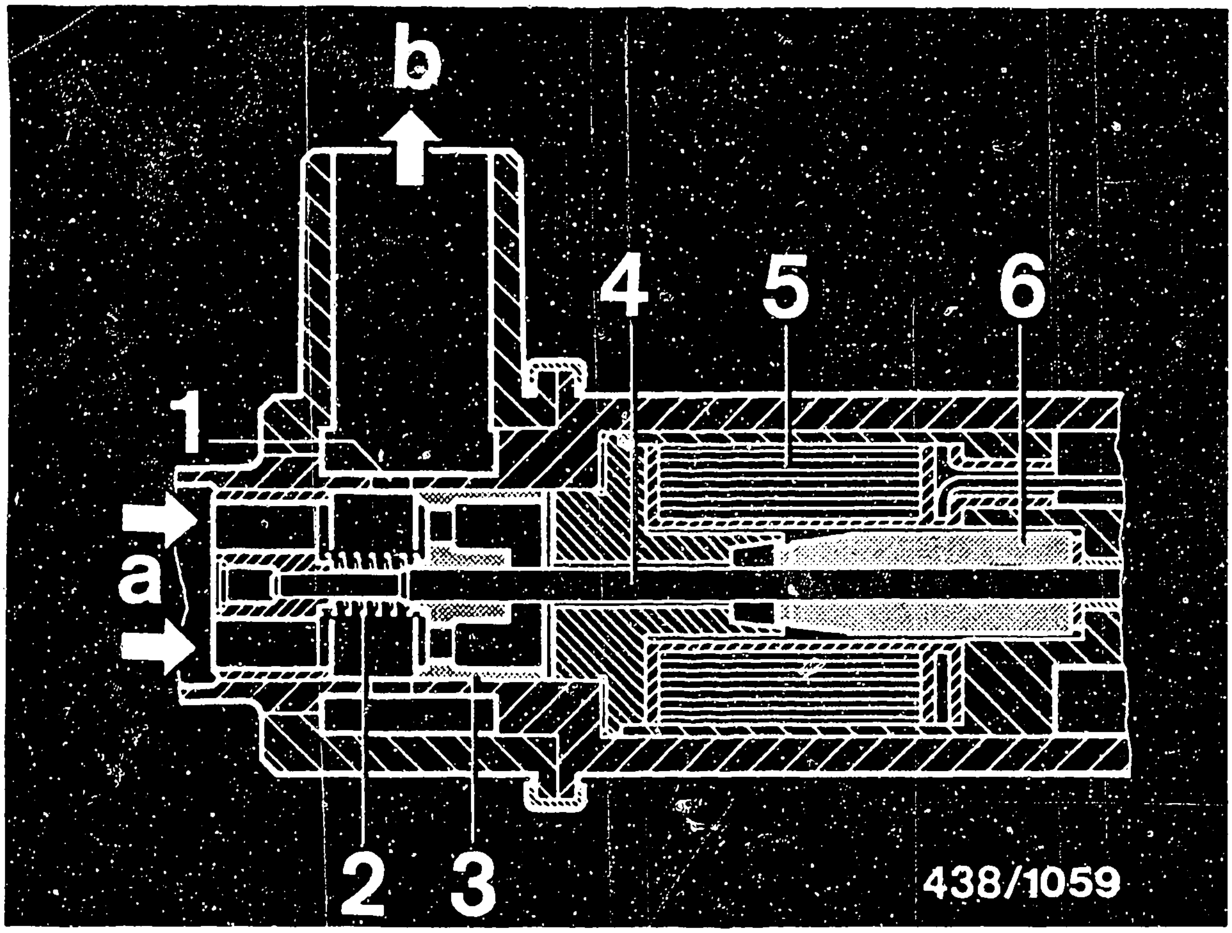
- Throttle valve microswitch

  Detects idle speed.

Additional control unit functions:

Connection 1 = Engine speed from terminal 1 of the ignition coil

Connection K = Air conditioner compressor cut-in

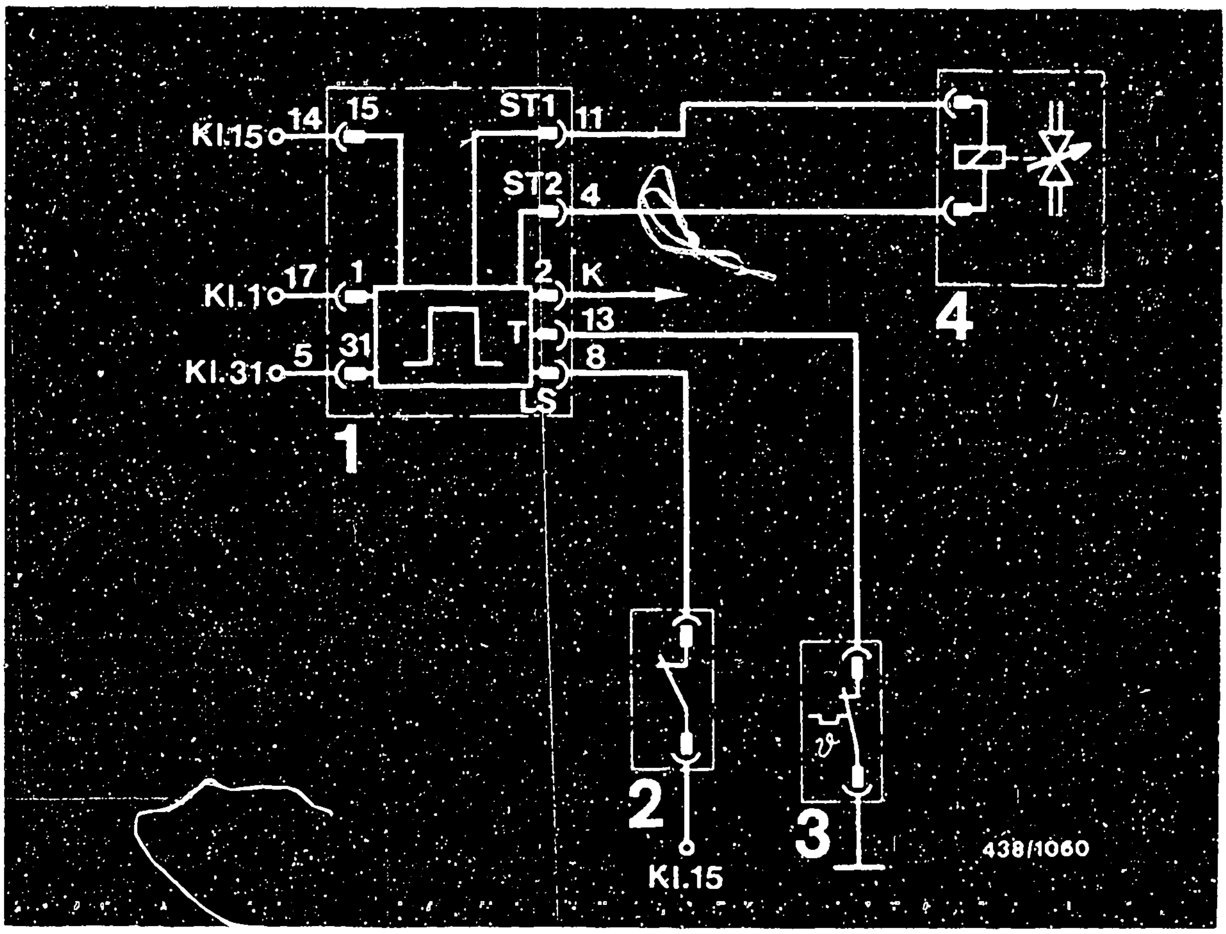


1 = Orifice
2 = Compression spring
3 = Plunger
4 = Shaft
5 = Solenoid coil
6 = Solenoid armature
a = Air inlet
b = Air outlet

Idle speed setting device

- Engine cold -- orifice is wide open
  Turn on ignition
  Setting device target current: 30...100 mA
- Engine warm -- orifice is closed somewhat
  Setting device target current:
  Vehicle without air conditioner
  (or air conditioner turned off): 410...450 mA

  With air conditioner turned on
  Manual transmission 470...510 mA
  Automatic transmission 480...520 mA



1 = Control unit
2 = Throttle valve microswitch
3 = Thermostatic switch
4 = Idle speed setting device
K = To the air conditioner compressor

22.3 Electrical-circuit diagram

The thermostatic switch and the throttle valve microswitch are also used for idle speed stabilization as well with the overrun fuel cutoff system.

22.4 Testing information

Check all leads for continuity and proper connection.

• Control unit

Check connections in socket after unplugging control unit.

Inputs:

Connection 14/15 = Battery (plus) from terminal 15

Connection 17/1 = Speed impulses from terminal 1 (ignition coil)

Connection 5/31 = Ground (minus)

Connection K/2 = Goes to air conditioner compressor

Connection 13/T = Ground from thermostatic switch (only at engine temperatures $\leqq$ +20°C)

Connection 8/LS = Battery voltage received from terminal 15 via microswitch with throttle valve in idle position

Outputs:

Connection 11/ST1 = Goes to idle speed setting device

Connection 4/ST2 = Goes to idle speed setting device

● Microswitch

Check coupling connections. Do not unplug the connector behind the throttle valve assembly.

Input: Battery voltage via terminal 15
Output: Battery voltage out when throttle is in idle position

● Thermostatic switch

Check the connections with the connectors unplugged.

Below +20°C: Contact closed (0 Ω)
Above +40°C: Contact open (∞ Ω)

● Control unit

Unplug connector from idle speed setting device. Turn on ignition. Voltage at connector should be approx. battery voltage. Otherwise replace control unit.

● Idle speed setting device

Bring engine to operating temperature. Reconnect plug at idle speed setting device. If the oscillations of the idle speed setting device cannot be felt, replace the idle speed setting device.

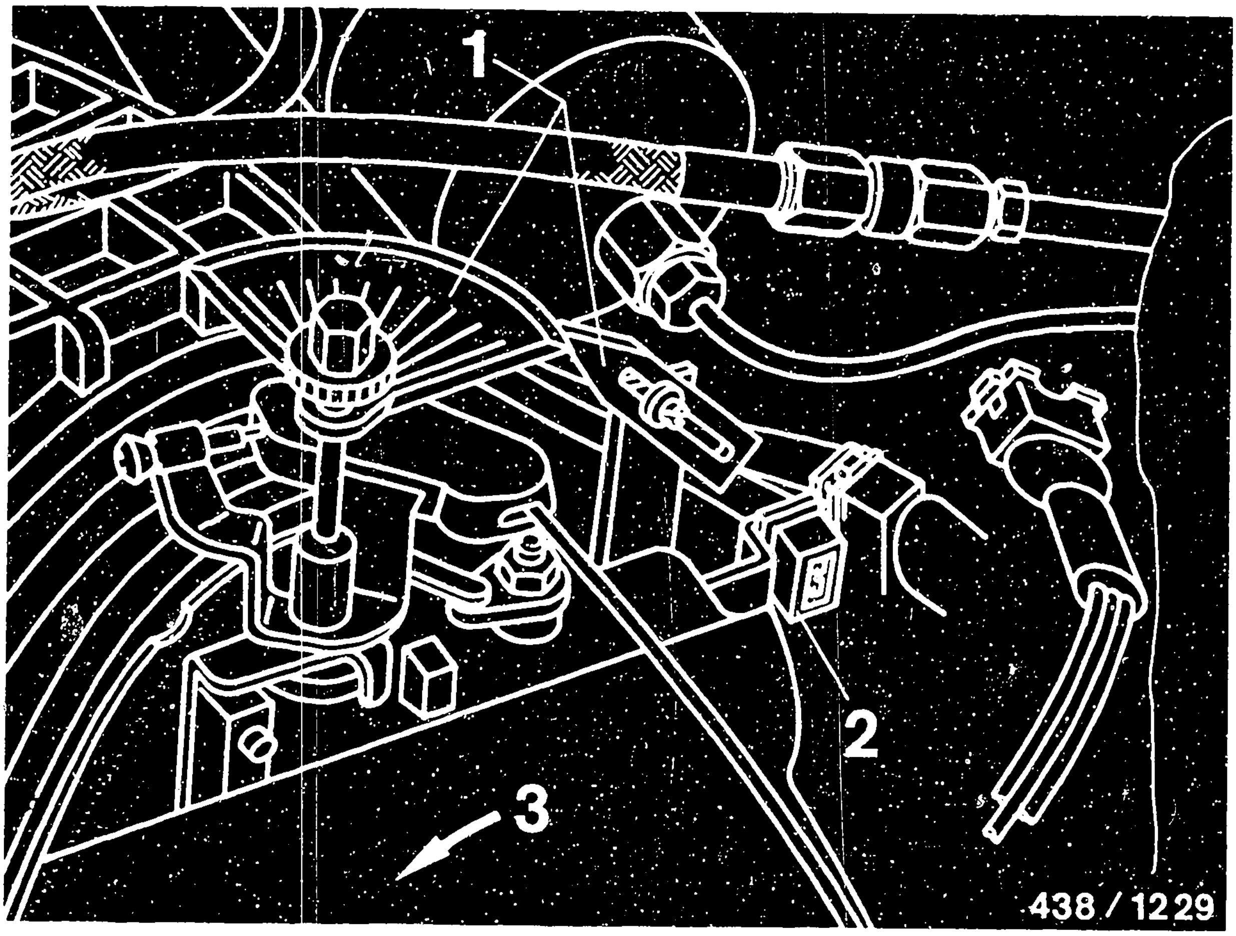
● Test values

Idle speed

Air conditioner off	730...870 min^{-1}
Air conditioner on	830...970 min^{-1}

Idle speed setting device current

Air conditioner off	410...450 mA
Air conditioner on	
Manual transmission	470...510 mA
Automatic transmission	480...520 mA



1 = Protractor KDJE-7462
2 = Throttle valve microswitch connector
3 = Microswitch (hidden beneath the throttle valve)

22.5 Adjusting the microswitch

Microswitch adjustment is checked using protractor KDJE-7462 and a multimeter.

The switch contact must be closed with the throttle valve in idle position, and opened at a throttle valve deflection of 1...2.5°

The throttle valve assembly must be removed to adjust or replace the microswitch.

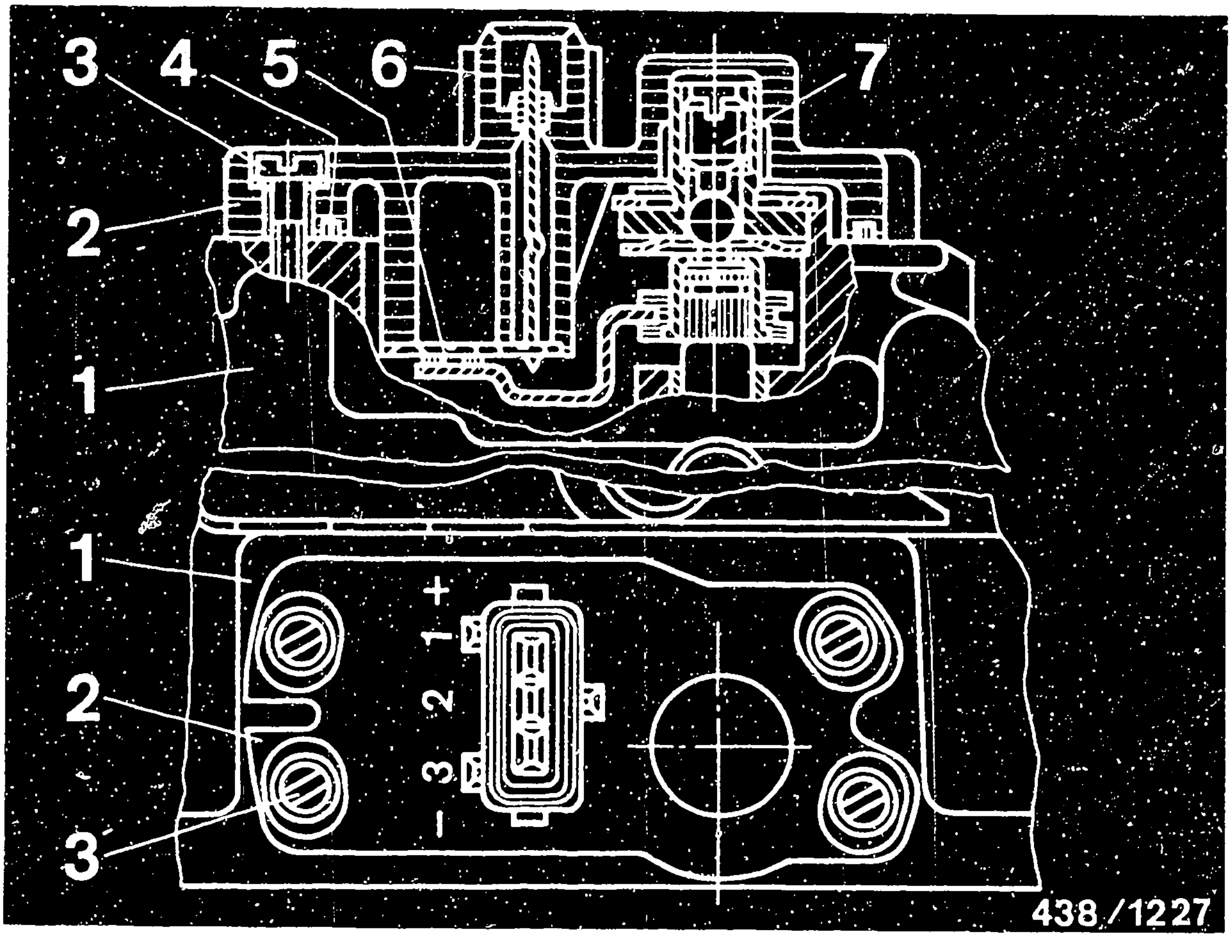
23. Air flow sensor with potentiometer

23.1 Design, operation

Air flow sensors 0 438 121 024 and 0 438 121 025, standard equipment as of July 1983, are equipped with protractors for indicating fuel consumption.

The protractor, designed as a potentiometer, is mounted on the fixed bearing of the air flow sensor housing.

It comprises a fixed potentiometer housing and a rotary brush wiper.



1 = Air flow sensor housing
2 = Potentiometer housing
3 = Fillister-head screw
4 = Gasket
5 = Brush wiper
6 = 3-pin connector
7 = Fixed bearing

A voltage of 5 VDC is supplied to the potentiometer by the 3-pin connector. The potentiometer outputs a voltage between 0 and 5 V depending upon the position of the sensor plate (idle, part-load, full-load). This load-dependent voltage is input to the on-board computer which uses this information to indicate fuel consumption by means of the combination instrument in the dashboard.

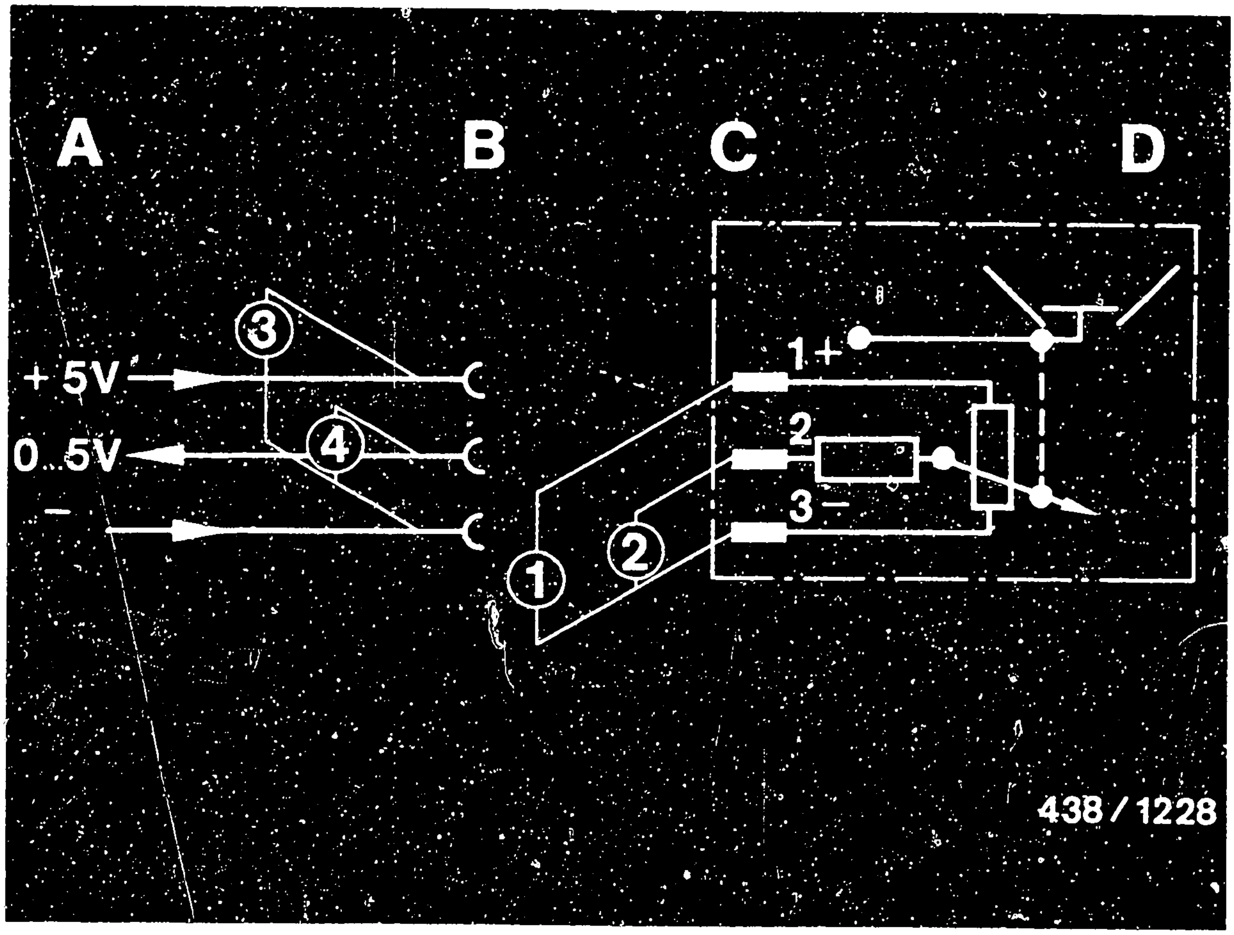
23.2 General information

The potentiometer housing can be replaced if necessary, and is available as a replacement part.
Customer service representatives cannot replace the brush wiper, however, because its retaining ring is permanently pressed onto the end of the main lever pivot shaft.

Take particular care when replacing the potentiometer housing so that the brush wiper is not damaged. Avoid any contact with the brush wiper.

23.3 Required test equipment

Multimeter with R_i equal to at least 20 kΩ/V (commercially available.



23.4 Electrical-circuit diagram

A = From the combination instrument
B = Connector housing of connection lead
C = Potentiometer connector
D = Potentiometer on air flow sensor

1 and 2 = resistance measurements (connector housing removed)

3 and 4 = voltage measurements (connector housing in place, ignition turned on)

23.5 Testing and adjustment

Unplug 3-pin connector. Connect ohmmeter to both outside contacts 1 and 3 of the connector.

Test value: 3000 ... 5000 ohms

no

Defective potentiometer housing -- replace.
Remove lacquer seal from the 4 mounting screws and remove screws. Carefully remove potemtiometer. Do not touch brush wiper. Install new potentiometer housing with gasket in place and retighten mounting screws until light resistance is felt.

yes

Connect ohmmeter to contacts 2 and 3 of the connector. Slowly move the sensor plate by hand between the idle and full-load positions.

Test value:
at idle: 500 ... 900 ohms
at full load: 3500 ... 6000 ohms

no

Display deviates from test value or jumps.

yes

no

Ohmmeter indicates ∞ ohms.
Defective brush wiper.
Replace air flow sensor.

yes

Continued at coordinates J23/J24

Testing and adjustment (continued)

Remove protective cap from connector housing and replace housing on connector.
Carefully connect voltmeter probes to the external contacts 1 and 3 of the connector housing.
Turn on ignition.

Test value: 4.7 ... 5.3 V

no → Check voltage of combination instrument.
Connect positive lead to contact 1 and ground lead to contact 3.

yes ↓

Carefully connect voltmeter probes to the external contacts 2 and 3 of the connector housing.
Turn on ignition.
Sensor plate in neutral position.

Test value: 0 V
The indicated voltage must increase immediately as soon as the sensor plate moves.

no → Adjust potentiometer housing:

Remove the lacquer seal from the 4 mounting screws and slightly loosen screws.
Turn the potentiometer housing in the vicinity of the slots until the voltmeter indicates 0 V.

Tighten the mounting screws to torque of 1.5 ... 2.0 Nm and reseal with lacquer.

yes ↓

Potentiometer O.K.
Replace protective cap on connector housing.

After-sales Service

Technical Bulletin

Packaging of goods under warranty

438

K-Jetronic (CIS)

VDT-I-438/101 B
10.1976

All components or assemblies of the K-Jetronic which are dispatched under warranty must be correctly and carefully packaged so that no further damage or impairments occur during transit, since these would not be covered by warranty.

Any fuel remnants must be removed from those K-Jetronic assemblies intended for dispatch, so as to eliminate any danger of fire during transit.

The intake openings and outlets of the assemblies must be sealed off with caps or plugs. As new products were fitted, the caps or plugs from these may be used.

The plunger of the fuel distributor is to be fitted with a protective cap of adequate size, or secured to the fuel distributor.

In addition, the assemblies are packed in tightly packed, well-sealed plastic sleeves. Fuel distributors and warm-up regulators are packed individually.

If components arrive damaged due to incorrect packaging or do not comply with these instructions, they can be returned and the warranty claim rejected.

BOSCH

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After-sales Service

Technical Bulletin

EXCHANGEABLE NON-RETURN VALVES
in electric fuel pumps 0 580 254 ..

VDT-I-438/104 En
3.1983
(Replaces Ed. 5.1982)

Electric fuel pump	Parts set (non-return valve + seal ring)	Non-return valve	Seal
0 580 254 001	1 587 010 500	---	---
002	500	---	---
0 580 254 003	502	---	---
004	502	---	---
005	502	---	---
006	502	---	---
007	500	---	---
948	005	---	---
949	002	---	---
950	006	---	---
951	006	---	---
952	002	---	---
953	501	---	---
954	002	---	---
956	002	---	---
957	002	---	---
958	002	---	---
959	002	---	---
960	002	---	---
961	002	---	---
962	002	---	---
963	005	---	---

Electric fuel pump	Parts set (non-return valve + seal ring)	Non-return valve	Seal ring
0 580 254 964	1 587 010 002	---	---
965	002	---	---
966	002	---	---
967	002	---	---
968	002	---	---
969	002	---	---
970	002	---	---
971	002	---	---
972	002	---	---
973	002	---	---
974	002	---	---
975	003 4	---	---
976	004 3	---	---
977	004 3	---	---
978	1 587 410 901	---	---
979	010 004 3	---	---
980	002	---	---
981	002	---	---
982 1	003 4	---	---
982 2	1 587 410 901	---	---
984	010 004 3	---	---
985	---	1 583 385 006	1 580 203 002
986	---	386 011	001
987	---	008	001
988	---	008	001
989	---	008	001
990	---	385 004	002
991	---	004	002
992	1 587 010 001	---	---
996	---	386 011	001
998	---	385 004	002
9 580 234 003	002	---	---
005	002	---	---

1 = up to FD 822 2 = from FD 823

3 = Parts set ..003 also possible (delivery-line connection at 90)

4 = Parts set ..004 also possible (delivery-line connection axial)

After-sales Service

Technical Bulletin

O-RING FOR K-JETRONIC INJECTION VALVES — VDT-I-438/108 En

0 437 502 — 7.1982

For K-Jetronic injection valves with O-ring seals the O-ring is available as a service part under Part No.: 3 430 210 600.

This O-ring is also listed on service-part microfiche EE...* together with other Jetronic service parts.

* See microfiche EE00 under 0 280 ..

Since the O-rings are exposed to extreme temperatures, they should be replaced whenever service work is performed.
"Unmetered air" which is drawn in through leaky injection valve seals is a frequent cause of trouble.

Please direct questions and comments concerning the contents to our authorized representative in your country.

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After-sales Service

Motor Vehicle Service Information

EXPORT VEHICLES WITH
EMISSION CONTROL SYSTEMS

VDT-I-Gen. 042 En.
12. 1981

K-Jetronic and L-Jetronic

Export vehicles for countries with stringent exhaust emission regulations are equipped with various emission control systems. To meet the legal requirements, these systems are installed either individually or in combination, depending on the model version.

Emission control system	installed predominantly in export vehicles				
	Sweden	Australia	Canada	USA	Japan
Exhaust-gas recirculation*	•	•	•	(•)	(•)
Secondary-air induction*	•	•	•	(•)	(•)
Secondary-air injection*	•	•	•	(•)	(•)
Catalytic converter*	-	-	-	•	•
Lambda closed-loop control	-	-	-	•	•

The vehicle-related After-Sales Service Instruction Manuals for the K-Jetronic and L-Jetronic describe the construction, function and operating principle of the emission control systems. The influence of these systems should be borne in mind particularly when adjusting the idle speed and CO concentration.

Export vehicles are sometimes also encountered in countries which do not have particularly stringent exhaust emission legislation. This Service Information publication summarizes the various emission control systems and provides information for the After-Sales Service in countries with exhaust emission legislation which does not require such emission control systems or unleaded fuel.

* Not made by Bosch

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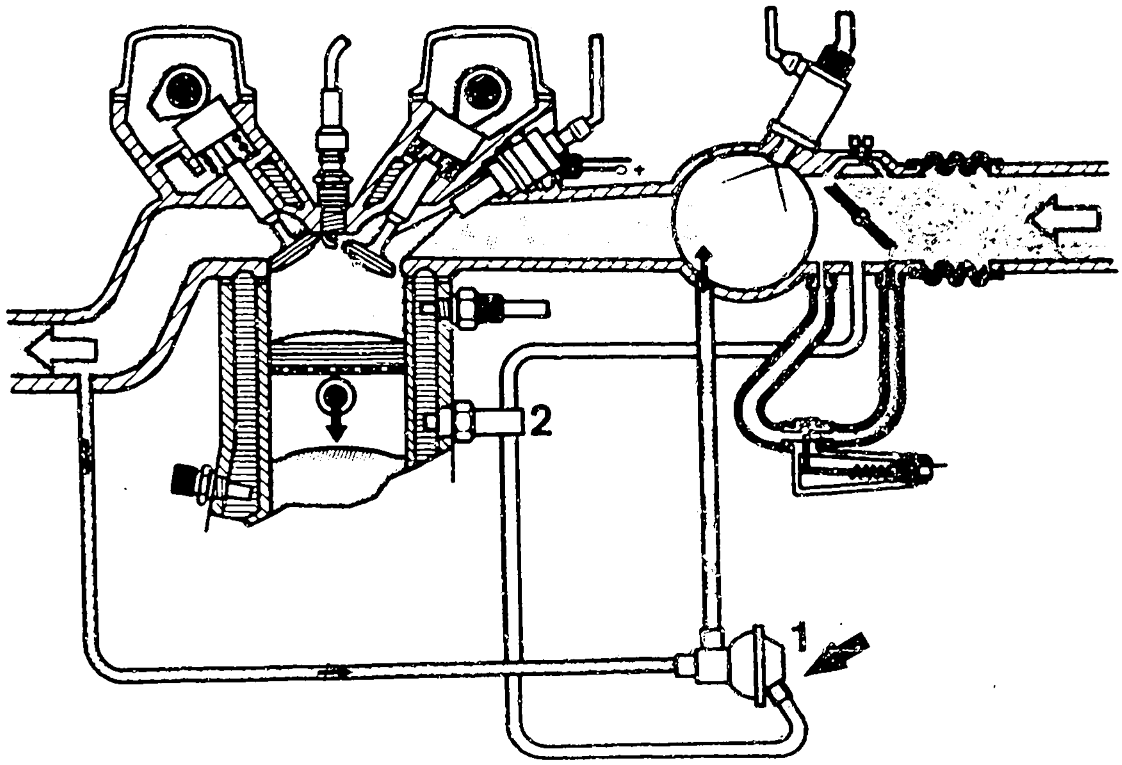
1. Exhaust-gas recirculation (EGR)



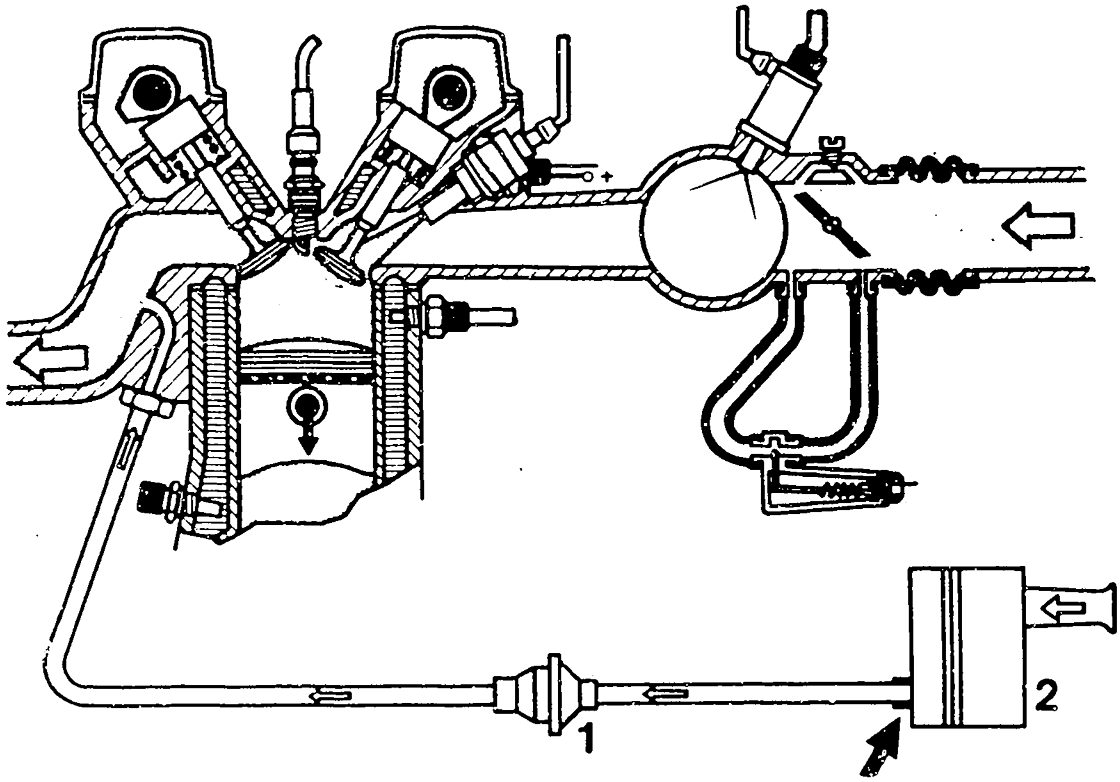
1 = Exhaust-gas recirculation valve   2 = Thermo-valve

Some of the exhaust gas is returned to the intake manifold via a vacuum-controlled exhaust-gas recirculation valve. This recirculation of exhaust gas into the combustion chamber lowers the combustion temperature and reduces the emission of nitrogen oxides (NOx). The thermo-valve and the position of the vacuum tapping port on the throttle-valve assembly ensure that exhaust gas is only recirculated when the engine is warm and only at part load. There is a reduction in engine speed of about 200 min^{-1}. Exhaust-gas recirculation is inoperative at idle, full-load and when the engine is cold.

When testing or adjusting the idle speed and CO concentration, remove and seal off the vacuum control line (arrow) on the exhaust-gas recirculation valve in order to ensure that the exhaust-gas recirculation system is inoperative.

In countries without stringent exhaust emission legislation it is not necessary to shut down the system.

2. Secondary-air induction (e.g. Volvo Pulsair system)



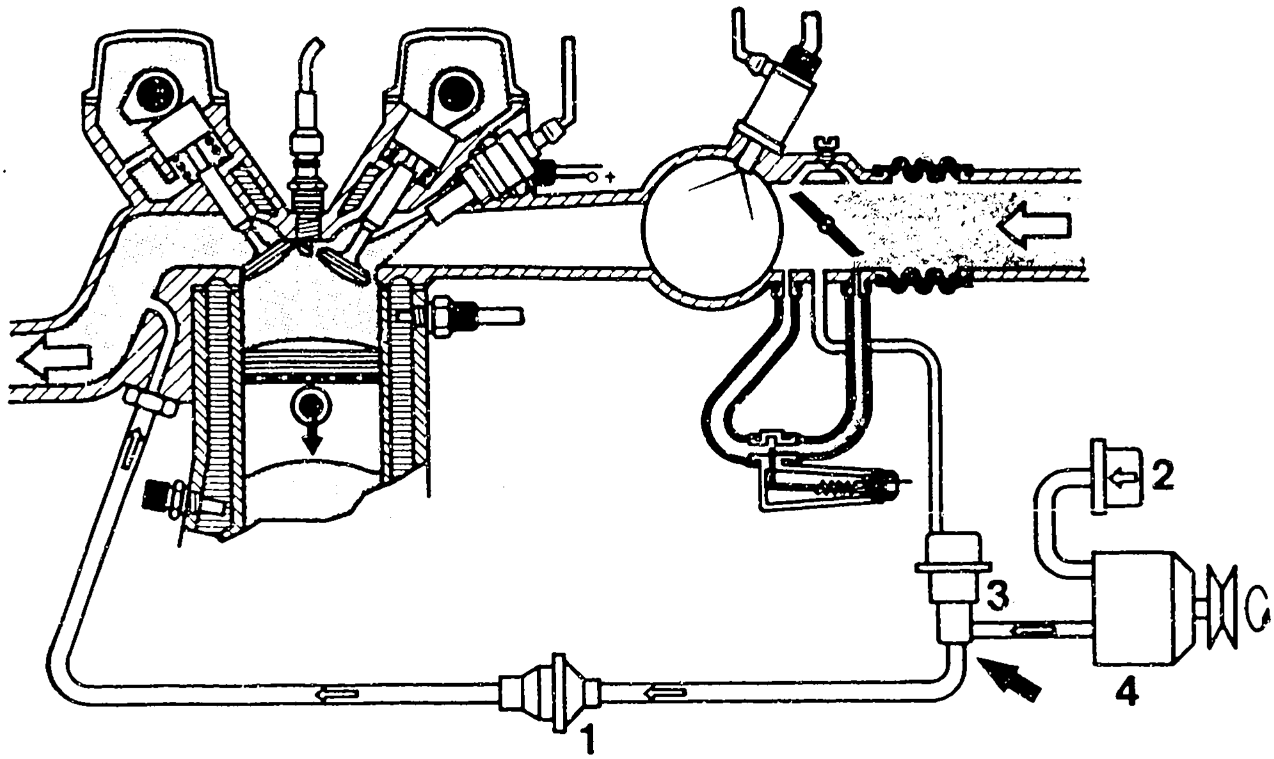
1 = Non-return valve 2 = Air filter

The pulsating alternation between overpressure and depression in the flow of exhaust gas inducts fresh air into the exhaust ports via a non-return valve. Unburned residues of carbon monoxide (CO) and hydrocarbons (HC) are partially after-burned, leading to fewer pollutants in the exhaust gas.

When testing or adjusting the idle speed and the CO concentration, the secondary-air induction system must be rendered inoperative. To do tnis, remove the hose between the non-return valve and the air filter on the air filter (arrow) and seal off tight with a plug.

In countries without stringent exhaust emission legislation it is not necessary to shut down the secondary-air induction system.

3. Secondary-air injection



1 = Non-return valve

2 = Air filter

3 = Change-over valve

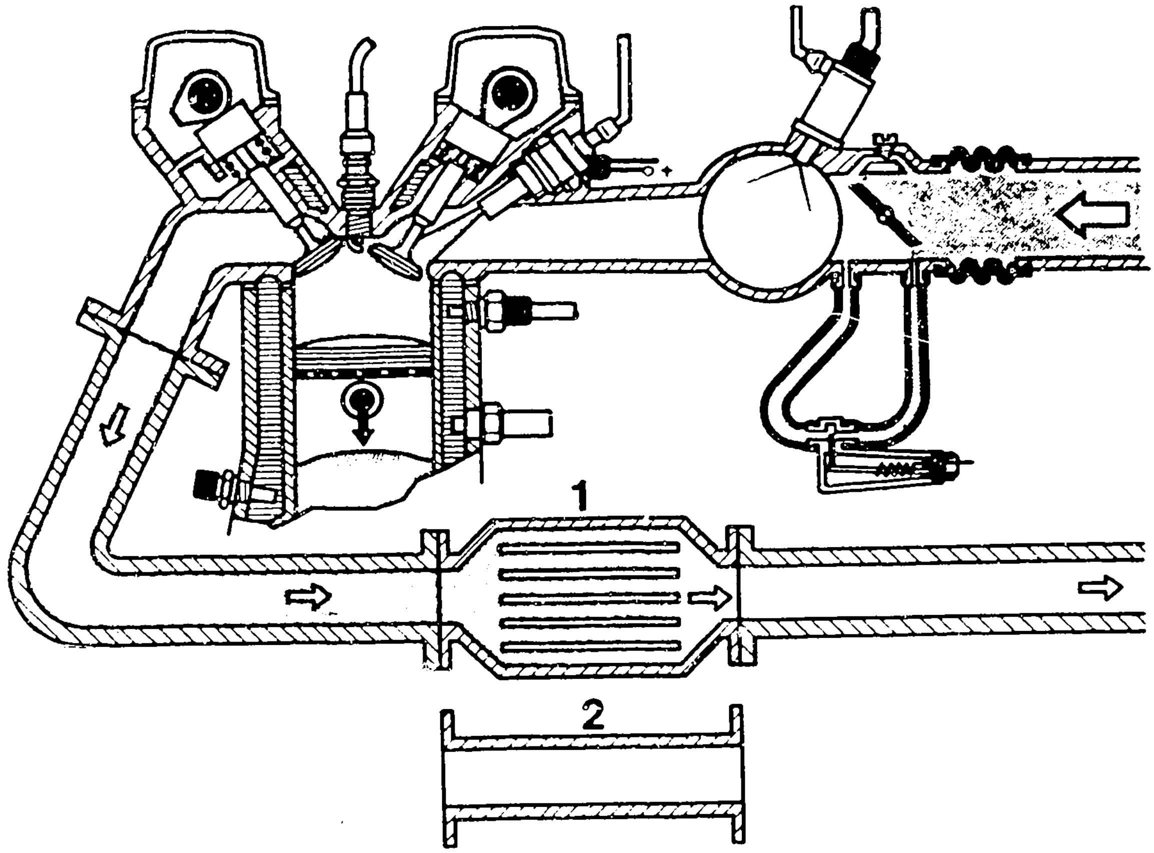
4 = Air pump

An air pump driven by the engine inducts fresh air through the air filter and forces it via a non-return valve into the exhaust ports. As in the case of secondary-air induction, there is a partial after-burning of the CO and HC residues. This makes the exhaust gas cleaner. A vacuum-controlled change-over valve controls the operation of the secondary-air injection system.

When testing or adjusting the idle speed and the CO concentration, shut down the secondary-air injection system. To do this, remove the hose from the outlet of the change-over valve (arrow) and seal off tight with a plug.

In countries without stringent exhaust emission legislation it is not necessary to shut down the secondary-air injection system.

4. Catalytic converter



1 = Catalytic converter 2 = Intermediate pipe

The single-bed catalyst installed in the exhaust system in export vehicles (also with lambda closed-loop control) reduces all three pollutants CO, HC and NOx to a minimum. The catalytic surface triggers chemical reactions of the pollutants, rendering them non-toxic.
Important: Proper operation only possible in conjunction with unleaded fuel (at present only in USA and Japan).

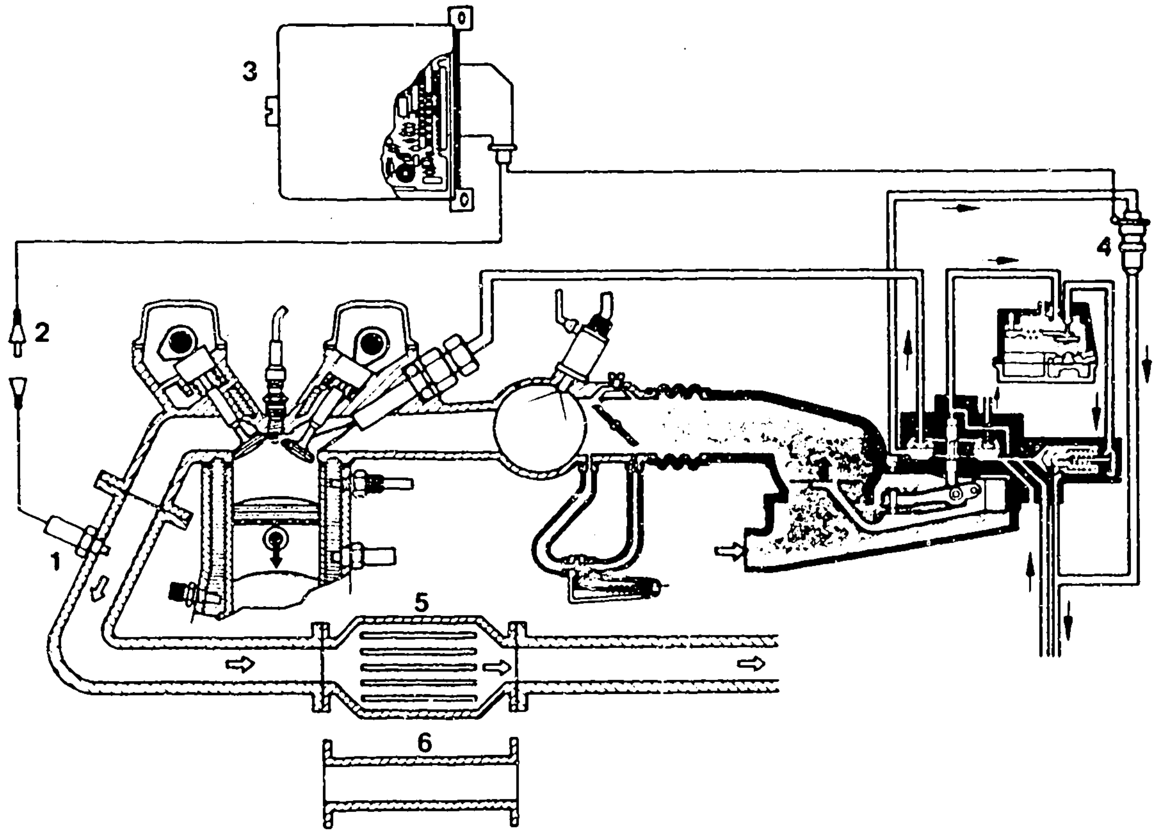
When testing or adjusting the idle speed and the CO concentration, the catalytic converter can be neglected since the exhaust-measuring point is upstream of the catalyst.

Caution!

If the vehicle is operated on leaded fuel (predominantly in countries without stringent exhaust emission legislation) the catalytic converter must be removed. If not removed, the catalytic converter would become clogged up and lead to a reduction in the power output of the engine.

Appropriate intermediate pipes for converting the exhaust system are available from the vehicle manufacturer.

5. Lambda closed-loop control



1 = Lambda sensor
2 = Plug
3 = Control unit
4 = Timing valve
5 = Catalytic converter
6 = Intermediate pipe

Export vehicles for the USA and Japan are equipped with lambda closed-loop control. This additional function of the K-Jetronic or L-Jetronic is not a downstream emission control system, but ensures a low pollutant content in the exhaust gas by means of optimum mixture preparation. Additional exhaust-gas recirculation, secondary-air induction or secondary-air injection is therefore not necessary in most cases. Like the catalytic converter, the lambda sensor (in the exhaust gas) operates only with unleaded fuel.
If the vehicle is operated on leaded fuel, the lambda sensor becomes clogged up and ceases to operate. The control unit detects this and switches from closed-loop to open-loop control. The system then operates on a fixed air-fuel ratio in the same manner as a K-Jetronic or L-Jetronic without lambda-closed-loop control. Before operating on leaded fuel, the lambda sensor should be removed and the installation hole should be closed off with a screw plug M18x1.5 (length of thread max. 8.5 mm). The disconnected plug (2) of the sensor connecting cable should be insulated and fastened to a suitable place on the vehicle body.

Caution!
Under no circumstances must the control unit or the timing valve be shut down on the lambda closed-loop control of the K-Jetronic.
The catalytic converter should be replaced by an intermediate pipe.

Published by:
Robert Bosch GmbH
Division KH
After-Sales Service Department
for Training and Technology
(KH/VSK)

After-sales Service

Motor Vehicle Service Information

HOT-STARTING PROBLEMS

on vehicles fitted with Jetronic

VDT-I-Gen. 050 En

9.1982

Customer complaints

If the vehicle is parked and the engine switched off after having been run at normal operating temperature, it often occurs that the engine proves difficult to start, or won't start at all, and when it does start it runs extremely roughly (only on 2 or 3 cylinders). The engine has to be accelerated a number of times before it runs smoothly.

Causes

For economic reasons ("stretching" of the mineral-oil reserves), it can happen that alcohol in varying quantities has been added to gasoline. Methanol is used for instance.
Such alcohol-added fuels, depending upon the amount of alcohol, adversely affect the hot-starting characteristics of the engine. The addition of alcohol raises the vapor pressure of the fuel and the result is that the boiling point of the alcohol-fuel mixture drops. This in turn leads to the formation of fuel-vapor locks in the fuel system when the engine has been switched off.

This means that when starting, and during the subsequent idle period, the air-fuel mixture is temporarily too lean.

Remedies

- Check the ignition and Jetronic systems, particularly for leaks.
- Changing to another brand of gasoline can sometimes cure the problem immediately.
- In many cases, fully depressing the gas pedal helps during starting, as does slightly depressing the gas pedal during the idle period until the engine runs smoothly.
- Fit the pulse relay 0 340 000 003 (refer also to VDT-I-438/105) in vehicles with K and D-Jetronic.
  This step, though, will still not fully alleviate the rough running of the engine during the starting off phase

Note:

The pulse relay 0 340 000 003 is NOT to be installed in vehicles fitted with L-Jetronic.

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Motor Vehicle Service Information

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COLD START - WARM UP
ACCELERATION PROBLEMS

VDT-I-Gen. 051 En
10.1982

in vehicles with Jetronic

Customer complaints

- Starting problems with a cold engine
- Engine bucking during warm up
- Uneven idle (speed fluctuations)
- Engine cuts out during acceleration (flat spot)
- Loss of output

Cause

When the ignition and the Jetronic have been checked and the test specifications given have been reached, a possible reason for the problems quoted could be coke residue on the intake valves.

The carbon residue thus present delays a continuous flow of fuel from the injection valve to the combustion chamber on account of its sponge effect.

As a result of this the air-fuel mixture can in some cases be so lean, that it can no longer be ignited.

Loss of output results from a reduction in the amount of cylinder filling and is caused by a very high coking.

Complex connections between qualities specific to the engine, the engine oil and fuel used, as well as relevant driving cycles (e.g. mainly short stretches) can cause such coking on the intake valves.

Remedy

Dismantle the intake valves and remove the deposits.

Please note

Various vehicle manufacturers are working at the moment on other measures, such as cleaning with additives. Results of these tests are not yet available.

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Motor Vehicle Service Information

LIQUID PETROLEUM GAS (AUTOGAS) SYSTEMS AND VEHICLES WITH K-JETRONIC

VDT-I-Gen. 052 En
10.1982

Fitting at a later stage

Vehicles with K or L-Jetronic are not suitable for fitting at a later stage with liquid petroleum gas (LPG) systems.

Numerous problems can occur, such as:

- Reduction of fuel flow through the injection valves due to deposits
- Stiffness or blocking of the K-Jetronic fuel distributor plunger (due to gumming or similar) in the course of time with "gas only operation."
- Increased danger of backfiring in the intake manifold (burbling) and thereby damage to the air-flow sensor.

Guarantee

Guarantee claims for failed Jetronic components from vehicles thus converted will not be accepted.

Conversion to liquid gas operation is made at the risk of the vehicle owner.

After-sales Service

Motor Vehicle Service Information

HOT-STARTING PROBLEMS — VDT-1-Gen. 056 En

VEHICLES WITH K-JETRONIC — 2.1983

This Service information contains special suggestions on how to remedy hot-starting problems concerning the general information contained in Service information VDT-I-Gen. 050 of 9.1982

Customer complaint (Symptom of trouble)

- After the vehicle has been standing for a short while the engine which is still hot has difficulty starting again.
- After hot-starting the engine runs rough (e.g. only on 2 or 3 cylinders).

Causes

- Formation of vapor bubbles in the hot fuel, particularly in the injection valves and injection lines, due to hydraulic leaks.
- Formation of vapor bubbles despite the absence of hydraulic leaks as a result of using a poor grade of fuel.

Owing to a high percentage (approx. 8%) of volatile alcohols (e.g. methanol) in the fuel its vapor pressure is higher than normal.
The consequences are:

- Formation of vapor bubbles
- Chattering and poor spray formation of the injection valves.
- Lean mixture composition in some cylinders due to a shortage of fuel.

Tests

Before testing, make sure that he ignition system and valve timing are O.K.

Checking the K-Jetronic system

Pay particular attention to the following sources of trouble:

- Hydraulic leaks in the fuel system with the engine hot.
  The vehicle-specific minimum pressures 10 and 20 minutes after stopping the engine must be observed.
- Leaks on injection valves
  No formation of drops within 15 seconds
- Zero-position of air-flow sensor plate.
  Top edge of air-flow sensor plate must be flush with the start of the conical section of the funnel.

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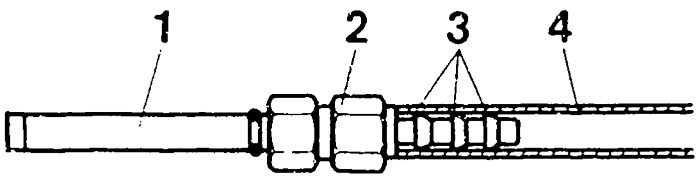
• Sealing edges (so-called "fishbone section") of the connecting parts must be securely seated in the polyamide injection line.
The fit may have become loose due to frequent changes of temperature.
If necessary, replace injection lines.



1 = Injection valve
2 = Connecting part
3 = Sealing edges
4 = Injection line

Finding

If the K-Jetronic system has been checked and if all the measured data are within the test-specification tolerance, then the grade of fuel can be taken as the cause of the trouble.

Corrective action

It may be sufficient to change the brand of fuel.

After-sales service solutions

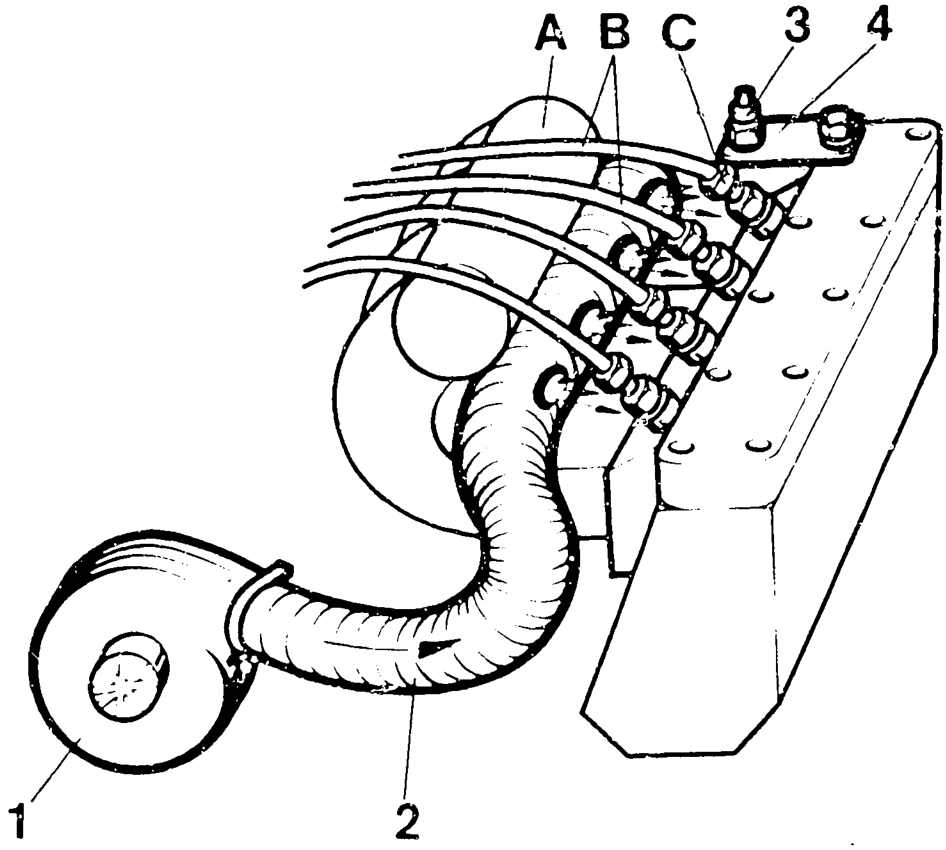
Recommendation for acceptable starting performance (shorter than 5 seconds)
Installation of time-pulse relay 0 340 000 003 as described in Technical Bulletin VDT-I-438/105 (3.1980).
Due to the time-pulse relay the start valve is energized intermittently during not-starting. Additional fuel is injected through the start valve and this compensates for the shortage of fuel from the injection lines caused by vapor bubbles.
However, smooth running of the engine after starting is only obtained by forcing the vapor bubbles out of the injection lines (by wide opening of the throttle).

Recommendation for good starting performance and smooth engine running:
Installation of injection valve cooling by means of additional fan and thermo-switch. The formation of vapor bubbles is (largely) prevented by this after-sales service measure.

Injection valve cooling

Necessary components and parts

- Centrifugal fan — e.g. 0 130 007 801 12 V/6A 4000 min^{-1}
  or VWW 035 959 175A, possibly with further connecting parts.
- Thermo-switch — VWW 035 959 481B On: 100°C, Off: 94°C
- Air guide hose — Aluminium or polyamide hose, 70 mm or 50 mm dia., flexible, oil-and fuel-resistant, heat-resistant up to + 120°C (commercially available, e.g. Westaflex, 4830 Gütersloh, Zum stillen Frieden 22).
- Hose clamps
- Brackets for fan and thermo-switch (user-fabricated)
- Relay, fuse holder with 8 A fuse, plug.



New components

1 = Centrifugal fan
2 = Air-guide hose
3 = Thermo-switch
4 = Holding plate

Parts of the engine

A = intake manifold
B = injection lines
C = injection valve

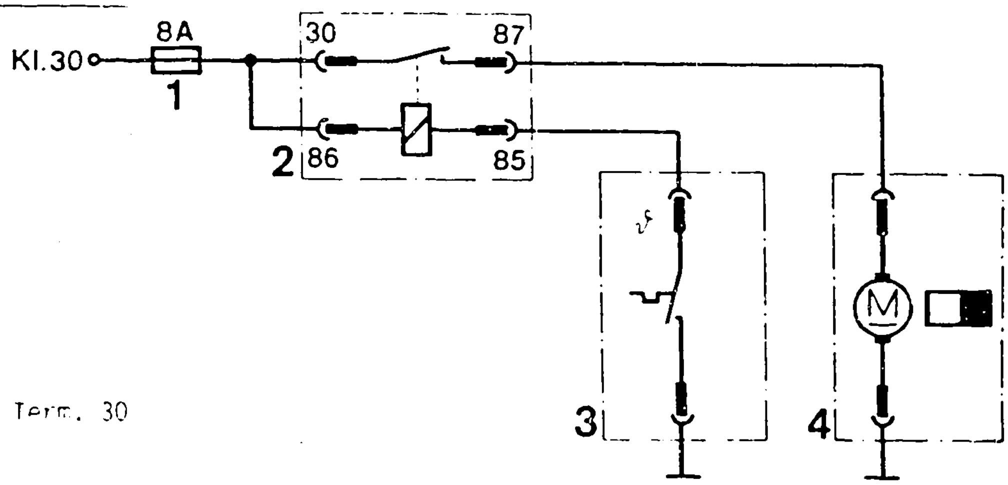
Layout

- The fan should be installed so that clean air is drawn in from a point which is as cool as possible. Protect the intake side from dirt.
  Example: A low position in the engine compartment behind the radiator grille or near the left-hand or right-hand side-wall.

- The air-guide hose is laid free of tension from the fan to the intake manifold. along the injection valves.
  Seal off the end of the hose and make openings at the side toward the injection valves. the openings having a diameter of approx. 25 mm.
  Fix the air-guide hose in position with hose clamps and bracket so that engine vibrations are absorbed by the flexible air-guide hose.

- Install the thermo-switch near the worst cooled injection valve (usually on the last cylinder). The place of installation should be selected such that the thermo-switch has. if possible. the same temperature as the injection valve. This applies both to the heat from the engine as well as to the cooling from the auxiliary fan. However. the flow of air from the fan must not be aimed directly at the thermo-switch (otherwise the on-time of the fan is too short).
  Example: By means of a holding plate the thermo-switch can be mounted on the valve cover or cylinder head by means of an existing screw.

Electric circuit



Kl.30 = Term. 30

1 = Fuse holder with 8 A fuse
2 = Relay with plug-in base
3 = Thermo-switch
4 = Fan

Make electric installation in accordance with the circuit diagram. Pay attention to ground connection and thermal contact of thermo-switch.

After-sales Service

Motor Vehicle Service Information

Electrical Equipment

FITTING POSITION AND MARKING OF
AIR-FLOW SENSOR PLATE 3 430 100 ..

VDT-I-Gen. 060 En
10.1983

In air-flow sensors for
K and KE-Jetronic

General information/fitting position

As a result of the stamping process during manufacturing, air-flow sensor plates have a sharp and a slightly rounded edge around the circumference. The sharp edge serves for measuring the air flow and must therefore be fitted so that it faces the air stream.

- The sharp measuring edge of the air-flow sensor plate points in the direction of the air filter.

- The slightly rounded edge points in the direction of the air funnel and intake manifold. 6 and 8 cylinder mixture-control units with downdraught air-flow sensor have air-flow sensor plates with a bezel on the otherwise usual rounded edge.

Marking

- Up till now most air-flow sensor plates have been marked on a surface with 5 punch marks or with the word "TOP". This marked surface must always be at the top of the air-flow sensor. This applies to both updraught and downdraught air-flow sensors.

- For precision reasons, an increasing number of air-flow sensor plates will be ground at the circumference during production as from mid-1983. On account of the sharp-edged surfaces on both sides, there will be no marking of any kind. These air-flow sensor plates can be fitted whichever way is desired.

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Automotive Equipment - After-Sales Service,
Department for Technical Publications KH/VDT,
Postfach 50, D-7000 Stuttgart 1

Published by: After-Sales Service, Department for Training and Technology (KH)VSK). Press date: 2.1984

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